SunExpert

Serving the UNIX Workstation Network

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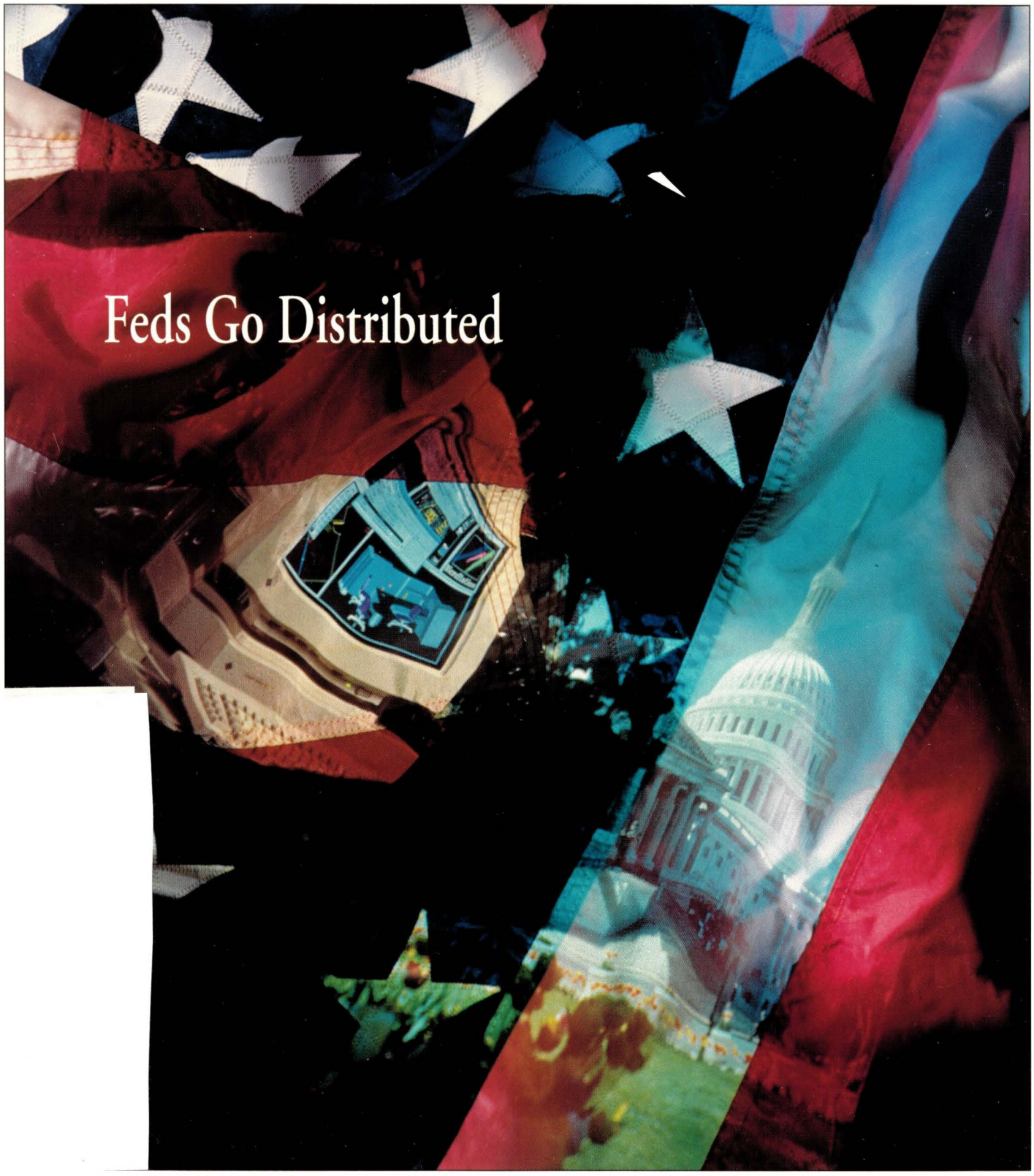

Feds Go Distributed

News: Tsunami Update

Reviews: PC-NFS, ScanWorX

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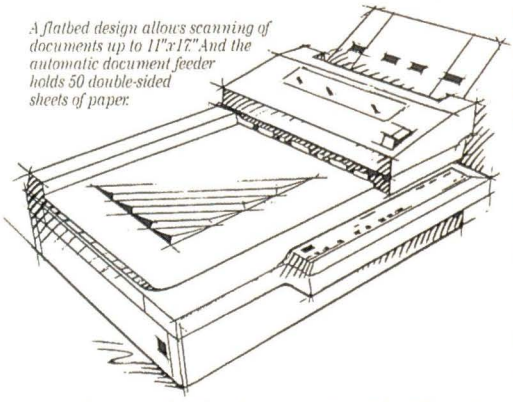

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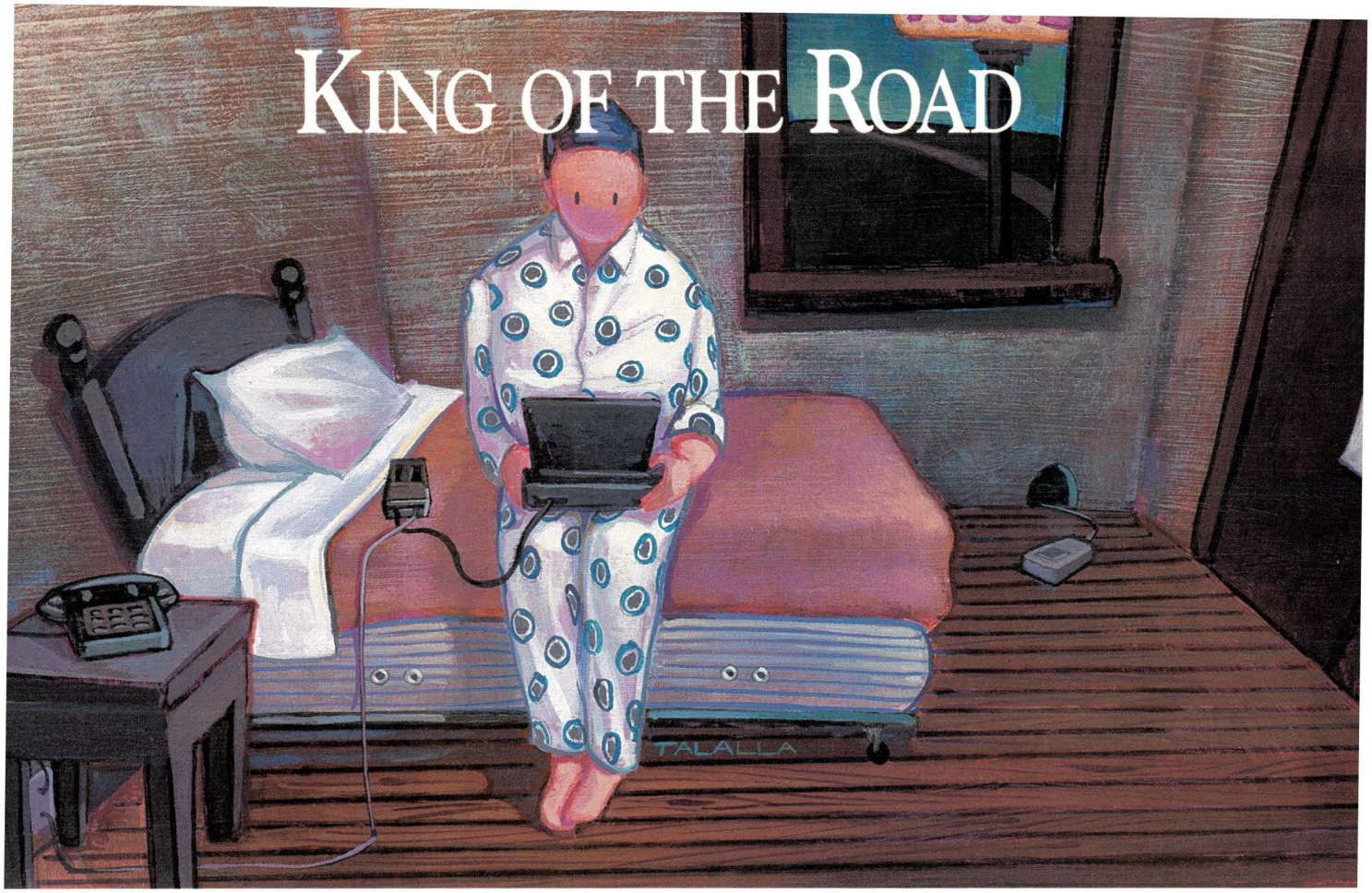

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Photograph of the Capitol courtesy of
Washington, DC
Convention and Visitors Association

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SUNEXPERT serves the UNIX workstation environment, emphasizing Sun, SPARC and Sun-compatible systems.

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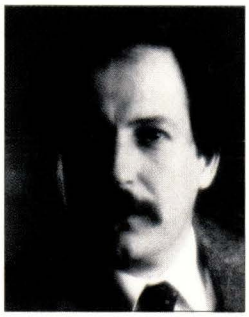
Editorial

Sun's Federal Case

"There are individuals, departments and even whole federal agencies pushing the boundaries of workstation computing–especially distributed computing. Running applications on the network–not on the mainframe, or even on standalone workstations–is the norm for many government agencies today," says Mary Jo Foley, Senior Editor. In this month's cover story, "Feds Go Distributed," Mary Jo discovers that federal systems aren't monolithic. But, whether downsizing, upsizing, rightsizing, smartsizing or, even, wrongsizing, federal Sun sites have one thing in common: maintaining fully distributed data over a network.



By now, we were led to believe, these networks ought to be GOSIP-compliant, at least in the Department of Defense. However, an RFP requirement does not an implementation reality make. According to our report, "POSIX and GOSIP: The Emperor's New Clothes?" by Willie Schatz, TCP/IP still rules the connectivity roost.

Also this month, *SunExpert* reviews the newest PC-NFS from SunSelect. It lets you use a PC like you should–as a smart terminal or crude workstation connected to a UNIX host. With its `rcp` and `ftp` function you can move files to and fro, and with `telnet` or `rsh` run commands on the host. For $415, it's cost-effective, and our reviewer found it reliable and easy to install.

In the just-in-case-you-missed-it category, "Fax Facts" (*SunExpert*, October, Page 87) contains a smattering of questions about your network. If you can, please take a look at it, photocopy it, fill it out and fax it in. The number is (617) 739-7003. As *SunExpert* continues to invest resources to fulfill the promise of our new tagline (it's just underneath the masthead), we will be asking for your help more often.

Thanks for your cooperation.

Doug Pryor

Doug Pryor

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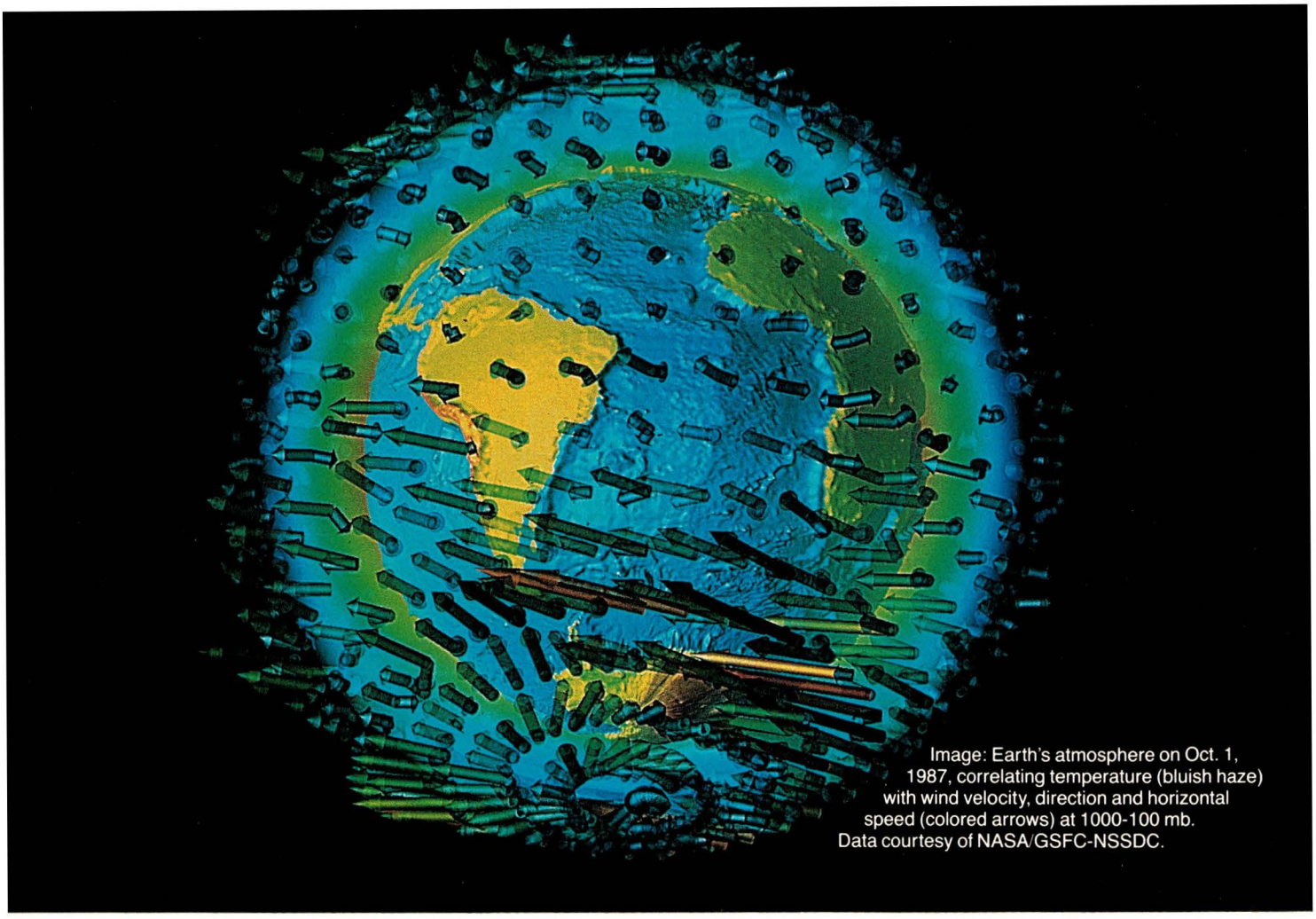

Image: Earth's atmosphere on Oct. 1, 1987, correlating temperature (bluish haze) with wind velocity, direction and horizontal speed (colored arrows) at 1000-100 mb. Data courtesy of NASA/GSFC-NSSDC.

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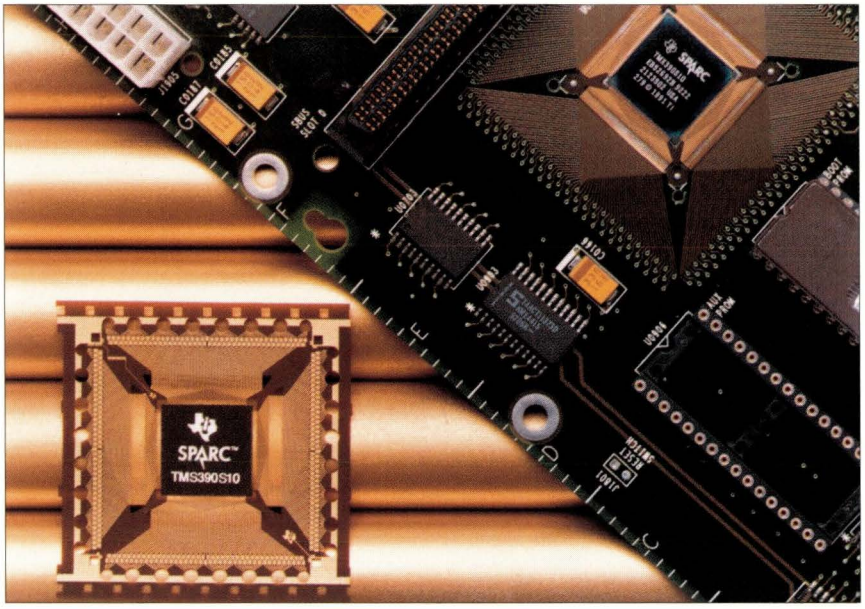
NEWS

The Calm Before the Tsunami



Texas Instruments Inc.'s TMS390S10, a k a microSPARC, is finding its way into X terminals, low-end workstations and various peripherals.

Shortly before Sun Microsystems Inc. is slated to make some major low-end SPARC system announcements, Texas Instruments Inc. filled in the missing details about its long-awaited Tsunami processor–the TMS390S10. The 32-bit Tsunami, formally known as microSPARC, clocks at 50 MHz and achieves speeds of more than 50 MIPS. When coupled with peripheral chips, such as the recently introduced NCR Corp. 89C100 and 89C105 master I/O and slave I/O processors, the microSPARC offers a complete, low-cost SPARC system solution.

The first systems expected to afford the microSPARC a home are X terminals, low-end desktop workstations and portable workstations. Sun Microsystems Computer Corp. (SMCC) is known to have been working on microSPARC-based X terminal and under-$5,000 workstation designs for some time now. Whether SMCC introduces just an X terminal, just a low-end workstation or both, it is likely to do so in early December.

But microSPARC will also turn up at the heart of routers, print controllers and in other embedded applications–à la the Fujitsu Microelectronics Inc.'s Advanced Products Division's SPARClite processor. Peripheral vendors have been sampling microSPARCs since mid-year, say TI officials.

In fact, for TI, the availability of microSPARC is a good story. As was the case with SuperSPARC, TI jointly developed microSPARC with SMCC. SMCC has been working to incorporate the processor into its next-generation products for several months. Other members of SPARC International have had access to the part since mid-year. General availability of sample quantities began in September. And volume production pricing of $179 (per 10,000 units) begins in the fourth quarter, TI says. Besides SMCC, Hyundai Electronics America's Axil Workstation division and C. Itoh Technology Inc.'s X terminal group are known to be nearing completion with microSPARC-based designs. SPARC notebook vendor Tadpole Technology Inc. confirms that it is working with the chip but says it is still at least six months away from delivering a microSPARC-based model.

Meanwhile, at press time, SuperSPARC's availability (or reported lack thereof) continued to be a stone around TI's neck. As of late September, a TI spokeswoman said the company had been shipping SuperSPARC chips to companies beyond Sun and the rest of the SPARC International executive membership since the third quarter of this year. During quarter three, the TI spokesman says, TI delivered 20,000 SuperSPARCs–more than 18,000 to Sun and the remainder to "other companies." Yet during the same time frame, a number of SPARCalike vendors continued to complain that they had yet to receive any SuperSPARCs.

Availability isn't the only problem. TI has had problems building SuperSPARCs to spec. It has abandoned–until first-quarter '93, at least–its 50-MHz clock-speed target for the part and instead is manufacturing 33- to 40-MHz SuperSPARCs. Because of the 64-bit superscalar processor's complexity, cranking out high volumes of consistently high-quality parts has been difficult, TI officials confirm. At least two independent sources connected with the SPARCalike market claim that TI has been discarding up to 50% of its SuperSPARC yields for quality reasons. TI denies these claims.

But at least two SPARCalike vendors have managed to wrest some SuperSPARCs from TI. Tatung Science & Technology Inc. and Axil were both demonstrating SuperSPARC-based, SPARCstation 10 compatibles at UNIX Expo in late September. Both companies expected to begin shipping by late October or November.–*mjf*

Sun Pumps Up the Software Volume

Software announcements aplenty have issued forth from the hallowed halls of SunSoft of late.

As promised, SunSoft continued its staged-access program for Solaris for X86. SunSoft has delivered an early-

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access version of Solaris 2.0 for X86 to between 50 and 100 software developers and OEMs. The early takers receive on a single CD the SunOS 5.0 operating system, OpenWindows, DeskSet and Open Look; the Intel Corp.-compatible version of the C compiler and development tools from SunPro (called ProWorks); documentation; and technical support and customer service. Like Solaris 2.0 for SPARC, Solaris for X86 is fully multithreaded. At UNIX Expo in late September, the OS was demonstrated on a multiprocessing Compaq Computer Corp. SystemPro machine. But user-accessible threads will not be available to SPARC- or Intel-based Solaris customers until SunSoft ships its next release–which should be sometime during the first quarter of 1993.

SunSoft continues to enhance Interactive UNIX, its low-end PC UNIX. Version 3.0.1 now supports Intel Corp.'s LP486 processor and the large European base of Ing. C. Olivetti & Co. S.P.A. PCs. SunSoft has also added the Korn Shell command interpreter, support for removable Bernoulli and Syquest drives and the ability to mount DOS 5.0 partitions (including those larger than 32 MB) for improved UNIX-DOS file sharing. SunSoft launched a trade-in program, designed to entice users of Santa Cruz Operation Xenix, UNIX and Open Desktop to switch to Interactive UNIX for a 50% discount off the system's $495 list price.

Several major independent software vendors (ISVs) announced they will be porting their apps to Solaris 2.0. Adobe Systems Inc., Mountain View, CA, has promised to port Photoshop and Illustrator to Solaris. Lotus Development Corp., Cambridge, MA, is moving Notes to Solaris. And Computer Associates International Inc., Islandia, NY, will port its CA-Unicenter systems management software–and possibly other applications–to Solaris. The Unicenter port will take about a year.

Other Sun planets made their own software-related announcements. SunPics will be working closely with Adobe under the terms of a technology and marketing agreement between Adobe and Sun Microsystems Inc. Sun will adopt Adobe's imaging technologies, PostScript and Display PostScript, while Adobe will be doing more application development for Solaris. Sun will incorporate Display PostScript in the Solaris computing environment for both SPARC- and Intel-based systems. SunPics will be using Adobe's PostScript Level 2 technology in SunPics' future software offerings. And SunSoft will include a selection of Adobe's Type 1 fonts in the Solaris environment.

SunPic's NeWSprinter 20 allows users to choose two paper sizes and two different resolutions–and prints at 20 ppm.

Sun Microsystems Computer Corp. (SMCC) announced that Information Resources Inc. (IRI), a developer of executive information and decision support systems (EIS/DS), has ported its formerly mainframe-only-based Express software to SPARCstations and SPARCservers running Solaris. Waltham, MA-based IRI offers a set of query and analysis tools, a multidimensional database that can import data from other relational and flat databases and a 4GL. Pricing for Express on single-user systems begins at $2,000; server pricing begins at $25,000.

Finally, SunSelect revealed that it acquired the 10-person company, Praxsys Technologies Inc., a Norwood, MA-based software developer specializing in PC-emulation technology. SunSelect says that Praxsys' technology will enable it to develop emulation products for all UNIX platforms. SunSelect currently sells SunPC software, a PC emulation package that works with an optional hardware acceleration SBus card, allowing DOS and Windows applications to run on SPARC systems.–*mjf*

SunPics Unveils Printer No. 2

SunPics has developed and is delivering its second NeWSprint-compatible printer, the NeWSprinter 20. The 20-ppm PostScript-compatible system employs Version 2.1 of NeWSprint.

NeWSprinter 20 allows dual-size printing, on both 8½-by-11-inch and 11-by-17-inch paper. It is equipped with two paper trays and can accommodate a customer-installable paper-handling "accessory," which is slated to be introduced by SunPics in early 1993. Users may select resolutions of 400 or 300 dpi. The duty cycle is rated at 50,000 sheets per month, making the printer suitable for high-volume workgroup printing. Like the SPARCprinter, NeWSprinter 20 is based on the Fujitsu Ltd./Xerox Corp. print engine.

Version 2.1 of SunPics' NeWSprint software is identical to Version 2.0, with the addition of a couple of new features, such as TIFF support, say SunPics officials.

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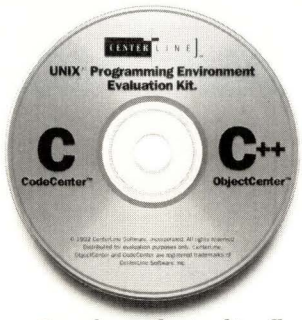

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NeWSprinter 20 lists for $4,995. SunPics is continuing to market its 12-ppm SPARCprinter, which lists for $2,695.

SunPics isn't the only one making waves in the NeWSprint-compatible market, however. Olympus Image Systems Inc. and Specialized Printing Solutions (see this month's New Products section) have also recently introduced 12- and 4-ppm models, respectively. And SRS Imaging of Irvine, CA, has unveiled a 17-ppm, 300-dpi model, called the Imager 17D, as well as a 4-ppm, 400-dpi Personal Imager printer.

The Imager 17D handles duplex printing (at about 7 ppm), via an optional duplexing unit. Like SRS' existing Imager 1200L, the 17D makes use of SRS' proprietary Fast Linked Architecture for SCSI Hosts, or FLASH, built-in SCSI interface.The printer retails for $6,995 and the duplexing unit for $795. Another option, an A-size, 1,500-sheet input bin that attaches in place of the lower feed tray and increases the printer's ability to handle large volumes of network printing traffic, lists for $895. And an envelope feeder, which enables 10-envelope-per-minute printing, sells for $795.

SRS is positioning the Personal Imager "either as a standalone desktop printer or as a complement to a higher volume network printer." The machine makes little noise and requires minimal desk space, according to company officials. Retail price is slightly under $2,000. A 250-sheet bin that can accommodate up to 50 labels or transparencies or 20 envelopes is available as an option.–*mjf*

Solbourne Shows Commercial Systems

Joining the mad rush of UNIX systems vendors into commercial applications, Solbourne Computer Inc. has introduced two servers that are optimized for database applications. In particular, the machines are targeted toward the Oracle Corp. Oracle database management system, and even more particularly, toward Oracle Financials–a suite of applications (general ledger, accounts payable, payroll and so on) that run on top of the Oracle database.

Solbourne company officials insist that these introductions do not mean they are abandoning the scientific and technical market, but that commercial RDBMS applications form their most profitable and fastest growing market. "This may be the 1980s of the computer industry," says new company President Carl Herrmann, "when people have to be a bit more pragmatic and practical about what really makes them money."

Solbourne is betting that what will make it money is an "Application Optimized Architecture," that is, systems optimized to run Oracle and then sold into commercial accounts. The company says that there will be other applications for which its systems will be optimized, but it isn't saying what those applications will be.

The two new servers are the deskside Model 6/700 departmental server and the larger 6/900. The 6/700 has one to four Texas Instruments Inc. SuperSPARC processors, 1.280 GB of memory, one VME slot, and 28 bytes of

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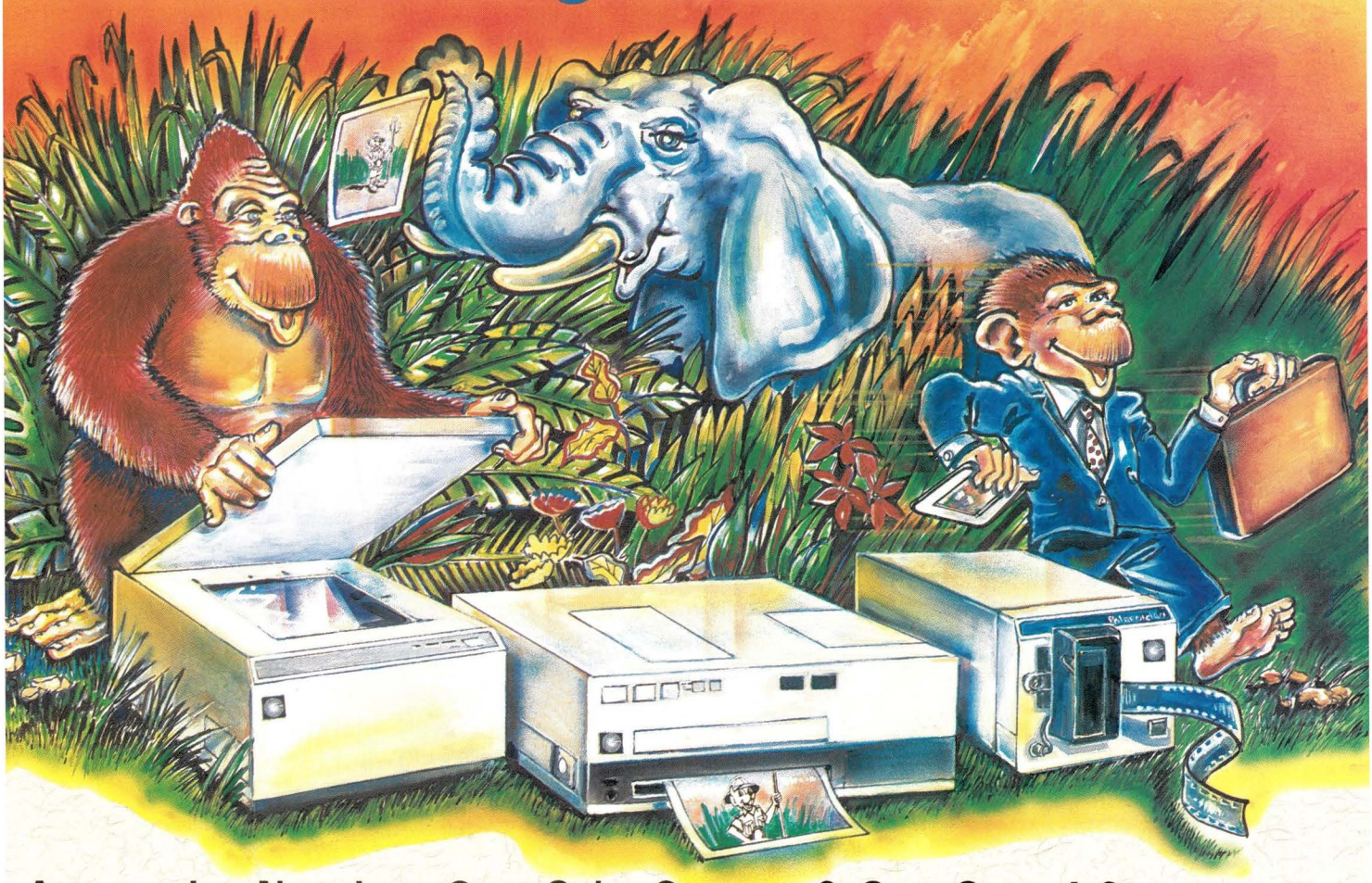

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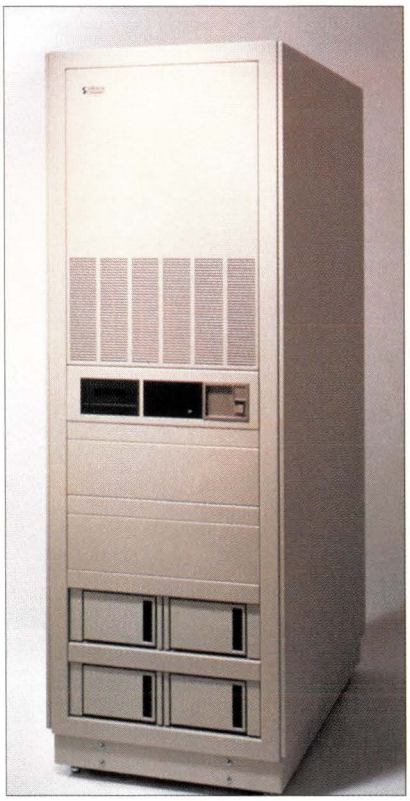

Solbourne Computer Inc.'s 6/900 server is optimized to run Oracle Financials, a suite of applications that run on the Oracle database.

SCSI disk capacity or a 62-GB IPI disk. The 900, meanwhile, is being called an "enterprise server" and is more or less openly offered as a mainframe replacement. It has one to eight SuperSPARCs, 2.3 GB of memory, seven VME slots, and 28 GB of SCSI or 172 GB of IPI disk space.

Solbourne says that pricing on the two machines runs from $51,000 to more than $200,000, depending on configuration options.

The Longmont, CO-based company says that the optimizations the two machines possess include improved I/O, better caching and large memories–all of which are important for database applications.

Solbourne was among the first vendors to bring out SPARC-based systems to compete with those from Sun. After early successes with multiple-processor servers, the company ran into serious problems late last year and early this. An attempt to enter the workstation market proved unrewarding. The company's servers encountered competition from Sun's own Galaxy line. There were consistent published reports of trouble between the company and its majority (at 52%) stockholder, Matsushita Electric Industrial Co. (MEI) of Japan. Finally, this year, company founder Doug McGregor resigned his position as CEO.

Now, however, the company says that its situation is improved. It has more or less abandoned the workstation market–"it wasn't a comfortable place for us," says Herrmann–and relations with MEI are supposed to be better.–*mjt*

Suns Bear Brunt of Koala Project

Sun Microsystems Inc. workstations, which have been used for everything from CAD/CAM to word processing (at this magazine, anyway), can now claim Koala bears on its list of satisfied users. At least by proxy.

The Australian Koala Foundation is a nonprofit organization founded to help preserve that remarkable animal, the koala, and the world which it inhabits. The koalas need all the help they can get. While not yet on the endangered species list, they are seri-

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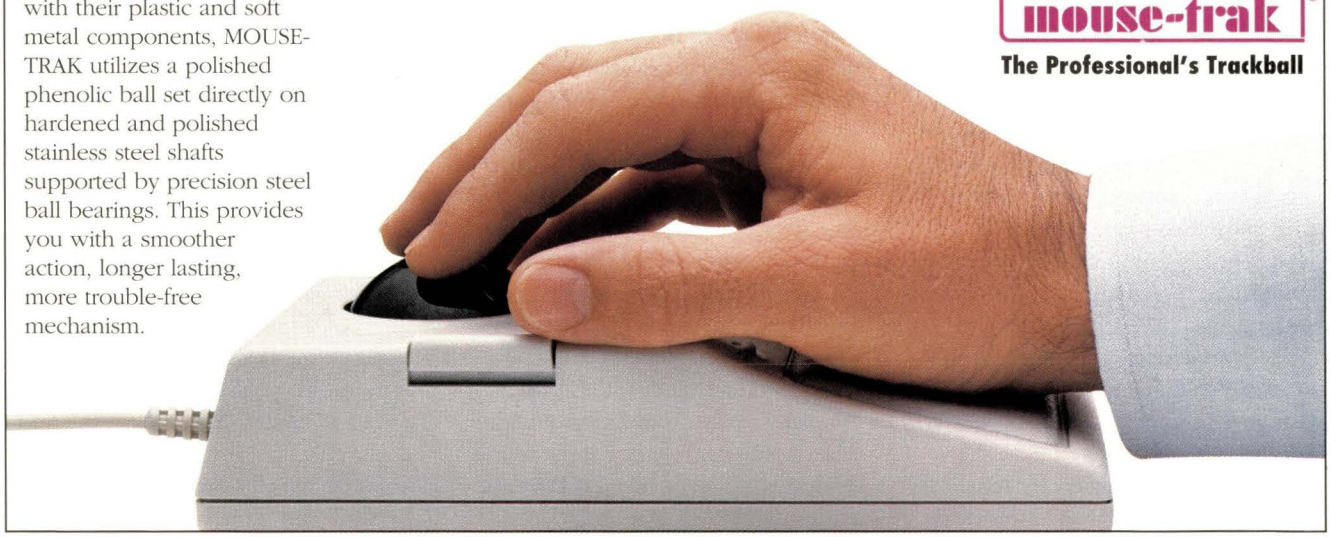

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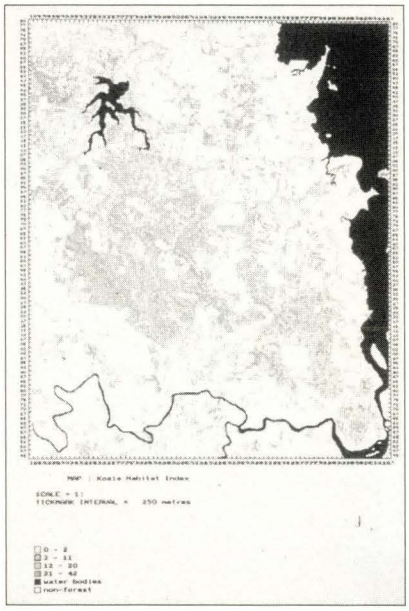
ously threatened by loss of habitat, disease, attacks by dogs and other domesticated animals and so on.

This September, the foundation announced that it had finished the Koala Atlas Program, one of the first-ever attempts to map out the actual range of the animal. In the process, the Foundation used a battery of sophisticated tools–including Sun workstations.



The Koala Atlas Program maps the range of koala bears using the Genemap GIS program on Sun Microsystems Inc. workstations.

Beginning in 1990, the Foundation surveyed approximately 25,000 acres of koala habitat in southeast Queensland. Volunteers visited 2,107 different field sites to collect data. This information was then fed into a database and linked to field site maps using the Genemap geographic information system (GIS) program running on several Sun workstations. These maps were then combined with LANDSAT images, maps from local and county authorities, topographical information and the like.

The Foundation says that the resulting super-map has provided information never known about koalas' habits. For instance, the maps seem to show that the koala actually ranges much farther from its core living areas than had been thought. This means, says the Foundation, that the animals must be protected in both their "core and fringe" areas.

The Koala Foundation is now attempting to similarly map the entire east coast of Australia. This is in addition to its regular activities of funding research projects, sponsoring educational programs and so on. It has an American arm, the Friends of the Australian Koala Foundation Inc., based in New York, and is supported by private contributions.–*mjt*

This Just In...

• ***Sun Microsystems Computer Corp.*** has made available four "box-swap" upgrades from SPARCstation 2GS to SPARCstation 10GS. Customers can upgrade to either the SPARCstation 10 Model 30 or Model 41. The box-swap upgrades include Sun's new GS frame buffer. This program changes the upgrade plan announced in May. Originally, the GS upgrades to SS10s were to be handled individually, with customers returning their entire SS2GS systems, including monitors. But "given the high demand coming from Sun's SPARCstation 2GS installed base," according to Sun, "Sun has formalized the upgrade path to SPARCstation 10GS rather than handle upgrades from SPARCstation 2GS on a case-by-case basis."

• The latest AIM benchmarks are out. And ***Sun Microsystems Inc.***'s published AIM results for its SS10s (Models 30 and 41) beat IBM's scores and run neck and neck with results for the Hewlett-Packard Co. 9000 Model 750. Sun's best numbers occurred in the area of price/peak performance. AIM benchmarks are designed to represent a "typical user load." The official benchmark mix is 20% RAM, 10% float, 10% pipe, 20% logic, 20% disk and 20% math. The benchmark measures both peak system performance and sustained performance under heavy system loads.

• In its continuing quest to lure publishing product vendors to SPARC, ***Sun Microsystems Inc.*** has announced that six prepress software and systems vendors will shortly market their products on the SPARCstation 10. Crosfield Electronics Ltd., Digital Technology Inc., DuPont/Camex, ECRM, Linotype-Hell Co. and System Integrators Inc. have heeded the siren call of the 10. Their products are used for output and production flow management, display ad makeup, spot and process color imaging, raster image processing and database management.

• A former Clearpoint Research Corp. division has bought its freedom in a management-led buyout. Called ***High Performance Storage Inc.*** (HiPerStor), Portsmouth, NH, the new company will provide data storage products to a variety of computer platforms. The company will eventually market a suite of high-performance tape and disk controller subsystems for Sun Microsystems Inc., Solbourne Computer Inc. and Silicon Graphics Inc. systems, though it is currently shipping product for Data General Corp. machines.

• The mail-order PC giant, ***Dell Computer Corp.*** of Austin, TX, has begun shipping UNIX System V Release 4, Issue 2.2. In addition to being a direct competitor to Sun's Solaris on Intel, Dell's UNIX is said to be one of the more widely known UNIXs for PC-class machines and one of the few to come directly from a PC hardware vendor. The new version will include Release 5 of X11, plus Open Look and Motif graphical user support. It can be had factory installed on Dell systems for $495.

• Yet another database company now says its development tools support Oracle. ***Cognos Inc.***, which divides itself between Ottawa and Burlington, MA, has announced that its Impromptu SQL query tool will now support Oracle via SQL* Net.

• ***ICL plc***, the multinational giant whose commercial systems use SPARC, has announced four new machines. They range from a desktop device to a mainframe-like server that can support several hundred users. The smallest, the Level 240 Desktop server, is meant for small workgroups and is priced at "under" $20,000. In the middle, at $50,000, is the Level 450 Slimline, which boasts two 40-MHz SPARCs and is meant for between 16 to 48 users. At the top are two machines, the Level 750 and the Level 752 Deskside, at $100,000. These

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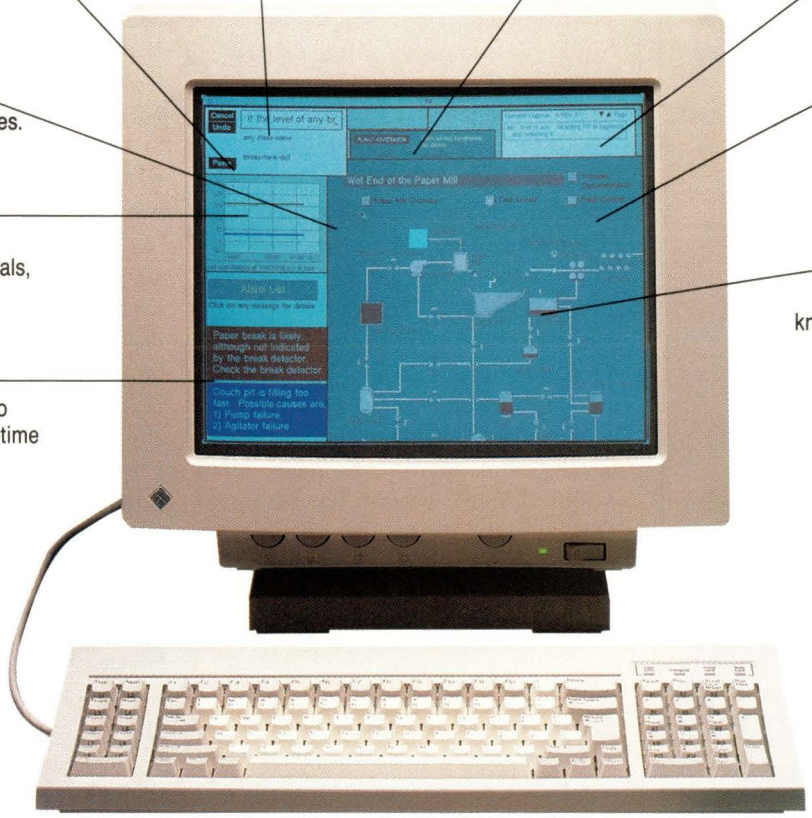

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have between two and, for the 752, four SPARCs and a disk capacity of up to 103 GB. Interested North American readers should contact ICL at its U.S. offices in Irvine, CA.

• The *Security Alliance for Enterprise* (SAFE), a group connected to *UNIX International Inc.* of Parsippany, NJ, has released a catalog of UNIX Security Awareness Materials. This is said to be a comprehensive guide to information on UNIX security issues. SAFE was formed last year to increase awareness of computer security issues.

• Sun seems doomed never to be safe from Motif, the OSF's GUI. *IXI Corp.*, the British firm whose U.S. offices are in San Ramon, CA, says that putting Motif on Sun systems looks like a "comfortable market niche." The company is now supplying low-cost Motif run times for OEMs that prefer to get their Motif in simple plug-and-play form and that might be disinclined to pay the OSF's $2,000 fee for Motif source code.

• While Prime Computer Inc. has ceased to exist, its heirs live on. One of these is *PrimeService*, Framingham, MA, a former service division of Prime and now a business unit of Computervision Corp. (Readers of an historical bent will remember that it was an ill-timed and ill-conceived attempt to take over Computervision that helped kill off the former Prime.) PrimeService already supports Sun workstations and markets a version of Novell's NetWare for UNIX for the Sun. In addition, the business unit says it will take over the sales and support of the former parent company's remaining inventory of 50 Series and Prime EXL Series machines.

• The Framingham, MA-based standards group, *The Object Management Group*, has announced that Petrochemical Open Software Corp. (POSC) will include in its application programming interface (API) specifications the OMG's Common Object Broker Architecture (COBRA). POSC is a Houston-based not-for-profit organization devoted to facilitating industry development of integrated technology, particularly in the petroleum industry. COBRA is a standard that the OMG has recently adopted as a centerpiece of the organization's effort to develop broadly supported object-oriented technology.

• Fax software for UNIX systems seems to be a hot market. *Samsung Software America*, Andover, MA, has announced deals with not one but three resellers for its Replix fax software. The three are Qualix Group, San Mateo, CA, Xecute, Edison, NJ, and Quest Research, Burnsville, MN. In addition to the Sun workstation, the Replix product is available on Hewlett-Packard Co. 700 systems, the IBM RISC System/6000 and PCs running SCO UNIX.

• Meanwhile, another former minicomputer giant is making a strong play in the storage business. *Data General Corp.*, Westboro MA, has added to its list of storage products with a family of disk and tape arrays compatible with Sun systems, as well as with IBM, Hewlett-Packard Co., Unisys Corp. and ICL platforms. Called the Clariion servers, the devices offer a variety of storage options. The Clariion disk arrays offer storage capacities of 2.5 GB to 24 GB in a case 2.7 square feet in size. Pricing begins at $28,000. There is also a tape system, the Clariion Tape Array, that contains five 3½-inch 4mm DAT drives. The tape system is $30,000.

• No, it hasn't got anything to do with trains, but Depot Express will help you run on time. Service and maintenance company, *Maintech*, of New York, has announced Depot Express as a new service. It is a depot repair program for monitors–particularly, but not exclusively, Sun monitors–workstations, video terminals and keyboards. You drop it off, and they fix it within four hours. They also do door-to-door delivery, so you really don't even have to drop it off. The Depot Express is geared toward self-maintainers in the New York area. ⊸

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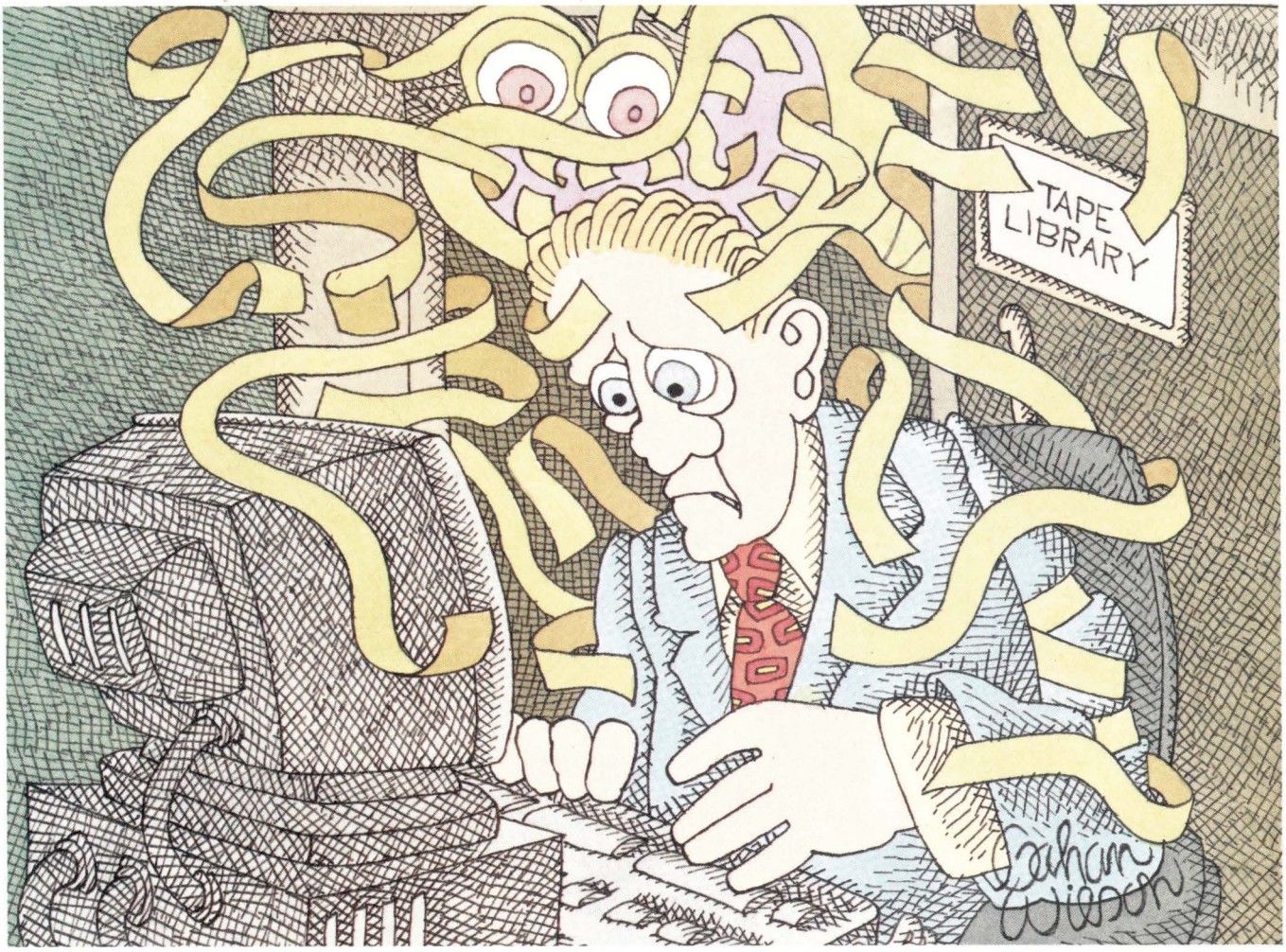
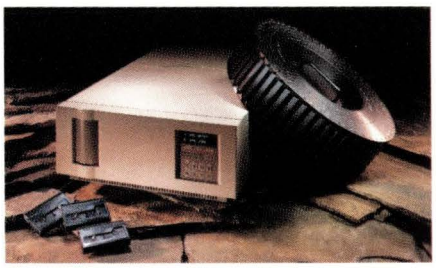
If your data is getting hard to manage...



it's time for the Lago DataWheel.



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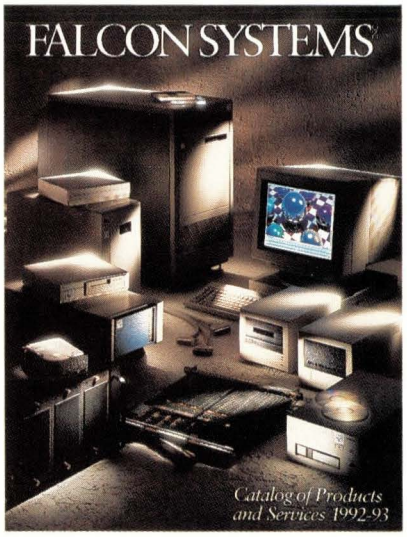

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TOM BARRETT

Mr. Protocol Gets into Hot Water

by MICHAEL O'BRIEN

"We could not contain our enthusiasm; with one accord we all took off our hats and yelled with all our might."
–First report of Great Fountain Geyser, the Cook Expedition, 1869

"Then [Echinus] may undergo what has been termed a ' "grand-mal" eruption,' during which the water turns from nearly clear to very muddy during the play, which will always be of considerable power and very long duration."
–T. Scott Bryan,
The Geysers of Yellowstone

"Don't quit your day job, kid."
–Sage advice to documentary filmmakers

Q: Geez! This place looks like hell! What's Mr. Protocol doing sitting in front of that hole in the ground? And what's that *smell*?

A: This place looks like hell because your Judeo-Christian mythology is showing again. In the winter, it looks like Norse hell. And that hole in the ground is the big reason why Mr. Protocol is here. We are, as we hinted last month, investigating the reason why anyone would want to buy a portable SPARC computer when IBM PC-compatible laptops are so popular and when Apple has just come out with the Powerbook series (which sure looks like about the first rationally priced computer Apple has produced yet, boy howdy).

And the smell? That's sulfur dioxide. Possibly hydrogen sulfide, if you're standing in the wrong place. Try moving. But be careful and stay on the boardwalk or you'll get to play a bit part in the *Inferno*.

Mr. Protocol, if you must know, is engaged in a spate of informal scientific research, an activity in which he periodically engages as a break from his everyday calling, which happens to be formal scientific research. We're standing in Yellowstone national park, and he is currently observing a geyser doing what geysers usually do, namely, not erupting. Having volunteered, he is now stuck with the midnight-to-3 a.m. shift here in the Upper Geyser basin, observing Plume geyser. He and other members of the Geyser Observation and Study Association are conducting a four-day, three-night


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study of Plume geyser, round the clock.

If this place looks like your idea of hell, that's because geysers are not kind to the surrounding landscape where they form. Their heat kills all the trees, and the minerals that they bring up evaporate and cover the ground with this white rock, called sinter. You can see that the entire hillside is covered with the stuff. Those holes in the rock are the geysers. Something like one-quarter of all the geysers in the world are here in the Upper Geyser Basin of Yellowstone, spread in a line along the Firehole River over a length of about three miles.

Human nature being what it is, observers have tried various techniques over the years to come up with some method of predicting geysers or at least for modeling their behavior. Some results are starting to come in from chaos theory, but more data are needed.

Collecting this data means sitting in the geyser basin, watching geysers, day and night, in a region where summer temperatures range from 85° during the day to 35° at night. Winter temperatures range from "darn cold" to "forget it," so not nearly as many data are taken. (You may note the careful use of the plural here. When each individual datum is the result of hours of observation, the common computer science notion of "data" as a collective noun, like land fill, begins to wear a little thin.)

Human nature being what it is, observers have tried various techniques over the years to come up with some method of predicting geysers or at least for modeling their behavior.

Many people think that Old Faithful is so named because its eruptions are so regular that you can set your watch by them. Not so. It is so called because it has erupted once every 45 to 100 minutes, every day and every night, since the first (nonnative) explorers discovered it in the mid-1800s. The period of time between eruptions, called the "interval," has not only changed over the years on the average, but individual intervals vary from one to the next. Old Faithful's eruptions can only be predicted one eruption in advance, by timing the duration of the previous eruption. The longer the eruption, the longer the succeeding interval, in a fairly linear relationship. No one has yet discovered a way to predict the length of an eruption.

The other geysers in the park, major and minor, regularly surprise (read: "frustrate") casual tourists and scientific observers alike, with a whole panoply of disgusting tricks, ranging from merely skipping an eruption, seemingly at random, to going entirely quiescent for years with no warning.

The result of his excursion into the field of geyser-gazing had an unfortunate effect on Mr. Protocol, never the most worldly of fellows. Having learned too much about computer networks, the treatment and perception of computer networks in what is called the "popular press" (never too popular with Mr. P.) makes his teeth hurt. Once he learned too much about geysers, the same happened to his view of nature documentaries. Therefore, when it came to the geyser basins, he decided to make his own documentary. It bids fair to be a horrendous amount of work for something not very good, but it provided an eye-opening opportunity for cross-fertilization and theory testing. This was to be a high-tech documentary.

We will ignore, for the nonce, the arcane intricacies of high-bandwidth 8mm cameras, wireless mikes, battery packs, chargers and all the kipple that causes airlines to charge extra for the baggage. We will concentrate on the computer end of things. The documentary has a script. Scripts change. This must be allowed for, under somewhat rigorous working conditions.

This means the script must be edited, preferably on something other than a 1933 Royal.

Also, there is the little matter of a shot list: No documentary is shot in order, so a list must be kept of which shots have been completed, which are yet to be done and which must be redone.

On the surface, an IBM PC-compatible laptop would be fine for this. However, Mr. Protocol was curious. PC-compatibles and the occasional Mac are used so regularly for this sort of thing that it seems as if people never consider anything else. Would a SPARC do the job? How well? And, was there anything else that a SPARC could do that one of the other breeds could not?

Mr. Protocol is glad you asked, because that's just what he asked. He got answers, too.

The first job was to find an available SPARC laptop. This worked out about as well as one might imagine. Various prosperous looking fellows shook Mr. Protocol's hand, took his card and were never heard from again. Then followed someone with a somewhat more reasonable attitude and Mr. P. was in business.

Mr. Protocol feels that the aptly named Tadpole might be a perfect candidate for taking on a trip, based on size alone. However, he has never gotten his mitts on one. The SPARC That Went to Yellowstone was an RDI Britelite.

A portable SPARC is in a position not generally found among Sun products (mainly because it isn't a Sun product, right?). Sun workstations, when first booted with the OS already installed, come up with a semi-nifty installation script that asks simple questions and performs complicated actions based on the answers. The result is a workstation that expects to spend the rest of its natural-born life either happily chattering away on a

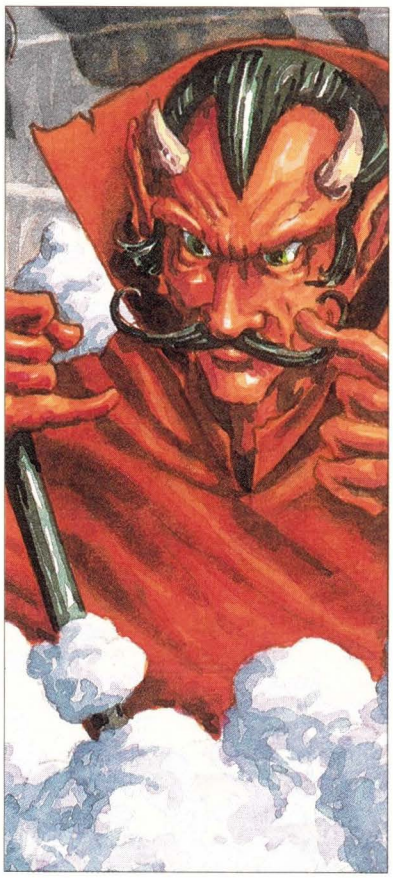
network or happily percolating away with a local disk in standalone mode and nevermore shall the two lifestyles meet, forever and ever, amen. Folks, this isn't what happens to a SPARC laptop. Unfortunately, if RDI has realized this, it didn't percolate down to the laptop Mr. Protocol got. Mr. Protocol did figure out, by means of some little diddling with the `rc.boot` files, how to convince the thing to switch between life on a net and life standalone, by renaming one file. What he did *not* figure out was how to convince it to boot *at all* if it were booted with the "switch" in the wrong "position"...and, obviously, the file renaming had to be done before taking the machine down, prior to the cutover from one mode to the other. Careful work, this. It's not hard to fix matters if it's connected to a network and it's misbooted in standalone mode, but if it's misbooted in network mode and there's no net, you have to provide a net before that machine will ever boot again. As Mr. P. remarked on making this discovery the hard way, "Wowsers."

This is one of the ways in which a SPARC beats out a PC: If you want to take files along that live on a file server, Mr. Protocol is here to tell you that it is much, much easier to bring a SPARC laptop up on a net and whisk the files across than it is to a) write a bunch of floppy disks or b) convince a PC, which has heretofore lived a life of blissful ignorance, suddenly to start speaking TCP/IP over an Ethernet.

Mr. P. does, however, allow that Apple Powerbooks might be able to get onto an AppleTalk network, if you happen to have one, without too much trouble. He's not played with one of those yet, either, so he doesn't know how easy it is to suddenly convince a standalone Powerbook to become a team player. He suspects that it's probably not hard. However, he begs that you will note well that if a file server lives on an Ethernet and not an AppletTalk net, it's probably going to be much easier to hook up a SPARC laptop than a Powerbook.

Very well, we now have a SPARC laptop ready to go. What now?

The next step is weight training. A



Britelite may be portable, but it is a whole lot briter than it is light. Mr. P.'s shoulders were of differing heights for some time after this trip. However, he does wish to point out that 10 D-size NiCad batteries spot-welded into a power pack make a weapon fearsome to behold, so if you're going into any dark alleys, a Britelite isn't a bad thing to have along.

Very well, we have the script all loaded up and we're ready to roll.

Not quite. Are we planning to lug this thing throughout the geyser basin? Mr. Protocol thought not. Not only is it heavier than one would wish (the Tadpole overcomes this, to be fair), but geyser water is notoriously unwonderful. Not only is it wet, but it sprays all over the place and happens to be death to any optical device it comes in contact with, such as a computer screen. (Being a saturated silica solution, it leaves permanent water spots.) The Britelite stayed in the room, where it shared a power strip with an improbable number of battery chargers.

So, some sort of printer is required. Here is where Mr. Protocol is pleased

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to report rampaging success. There is a company called CoSystems that makes, among other things, a parallel-port interface for the SBus. This has to be the world's cheapest SBus interface for any device, retailing as it does for all of $200. Mr. Protocol promptly snabbled one of these things, right away quick, you betcha.

Taking a Britelite apart to install an SBus interface is something that the Britelite manual says should be carried out by Britelite people: "No user-serviceable parts inside," as the saying goes. On Mr. Protocol's timetable, this did not wash.

Taking apart a Britelite turns out to be no harder than taking apart any other workstation, so long as you're willing to be greeted by the miniature cityscape of surface-mount technology, plus the usual annoying minimum of cables connecting the motherboard to the screen. Actually seating an SBus card inside turned out to be more of a challenge than Mr. P. is perhaps willing to admit: In fact the machine ceased to boot shortly after the interface was installed and did not come back to life again until it was disassembled once more upon arrival in Yellowstone and the card correctly seated. Mr. P. chalks this one up to experience, though travelling to Yellowstone with a nonworking computer and a suitcase full of hope took years off Mr. P.'s already problematic life-span.

Which leaves the issue of a printer. Mr. P.'s advice here is straightforward. Run out and plunk down a few hundred bucks for a Citizen PN-48 printer, which uses plain paper, cheap ribbons, has a bunch of emulation modes built in, can be battery operated, runs like a dream, produces better-looking output than your big printer (unless it's a laser printer) and is no bigger than zip. Folks, this is *the* perfect printer for a portable SPARC or a portable anything else, for that matter.

Mr. Protocol discovered, in a perfectly natural fashion, that most of the experts on geysers were to be found out actually observing the geysers. Therefore his script underwent substantial revision on arrival and the SPARC was much used. In fact it was easier to use than a laptop, at least for Mr. P., because it carried the Sun environment to which he was accustomed, allowing him to save his frustration for more important matters, such as actually shooting the documentary.

There was one other distinguishing feature of the SPARC that made it valuable. Because it was a real Sun-4 and not underpowered as PC-compatible laptops are underpowered compared with their larger brethren, it was a real scientific workstation with a full-speed disk. This allowed Mr. P. to load it up with all manner of interesting things upon which he was working and to spend the long evenings happily dinking away on things that, even if they ran on a PC, would run so slowly on a laptop PC that using them would

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be torture instead of pleasure.

This is the largest difference between using a PC or a Mac in the field and using a SPARC: With a SPARC, you have the same power as you have back home. Mr. P. was in a position not only to keep his script and shot lists in line, but to reduce data in the field: lots of it and quickly. Sun software, cantankerous as it may be to install and get running, is in the main more powerful than PC software. It had better be: It certainly costs more!

On the other hand, there are ways in which portable SPARCs are not ready for prime time. Mr. Protocol had to perform some fairly stiff system administration to get the machine configured for life in the field. Admittedly this is an operation that, in a given organization, probably would only have to be performed once, but it was fairly hair-raising at times. Also, there is some evidence that Britelite hardware may not be ready for prime time: There were some real problems with the power connector, which is badly placed and shows a tendency to break, especially as the mating connector on the power cord projects far to the rear of the machine. Also, it should be noted that10 D-sized NiCad cells is about four too many for reliability. The power pack as delivered would not hold much of a charge, either, because of problems with the contacts in the battery compartment or (more likely) various dead NiCad cells in the pack. With all that, once its idiosyncrasies were dealt with, it performed reliably and delightfully. And *rapidly.*

Some vacations are relaxing vacations, some are working vacations and some are right out in left field. This one was so far out that Mr. P. couldn't even see home plate on a clear day. He has now lived something of the lifestyle of Steven K. Roberts, doing high technology in the (relative) wilderness, and it provides a study in contrast that he found fascinating. Mr. P. has no argument with his contemporaries who, when they head for the outback, remove all higher technology, right down to their wristwatches (though of course Mr. P. doesn't wear a watch, relying as he does on Network Time Protocol packets). Mr. P. occasionally succumbs to this viewpoint and has a wonderful time when he does. However, he also feels that contrast is the spice of life and he thoroughly enjoyed the opportunity to combine high technology with the backwoods in this fashion.

He also got the best footage ever shot of Fan and Mortar Geysers in full eruption, from start to finish, bar none.

Chocolate Chip Cookie Hall of Fame Dept.

Thanks to Jim O'Hara, Susan White and Andataco for the loan of the RDI Britelite and to Steve Martinez of CoSystems for the loan of a CoPop. Large numbers of Big Stuf Ding-Dongs to you all. ➸

Mike O'Brien has been noodling around the UNIX world for far too long a time. He knows he started out with UNIX Research Version 5 (not System V, he hastens to point out), but forgets the year. He thinks it was around 1975 or so.

He founded and ran the first nationwide UNIX Users Group Software Distribution Center. He worked at Rand during the glory days of the Rand editor and the MH mail system, helped build CSNET (first at Rand and later at BBN Labs Inc.) and is now at an aerospace research corporation.

Mr. Protocol refuses to divulge his qualifications and may, in fact, have none whatsoever. His email address is amp@expert.com.

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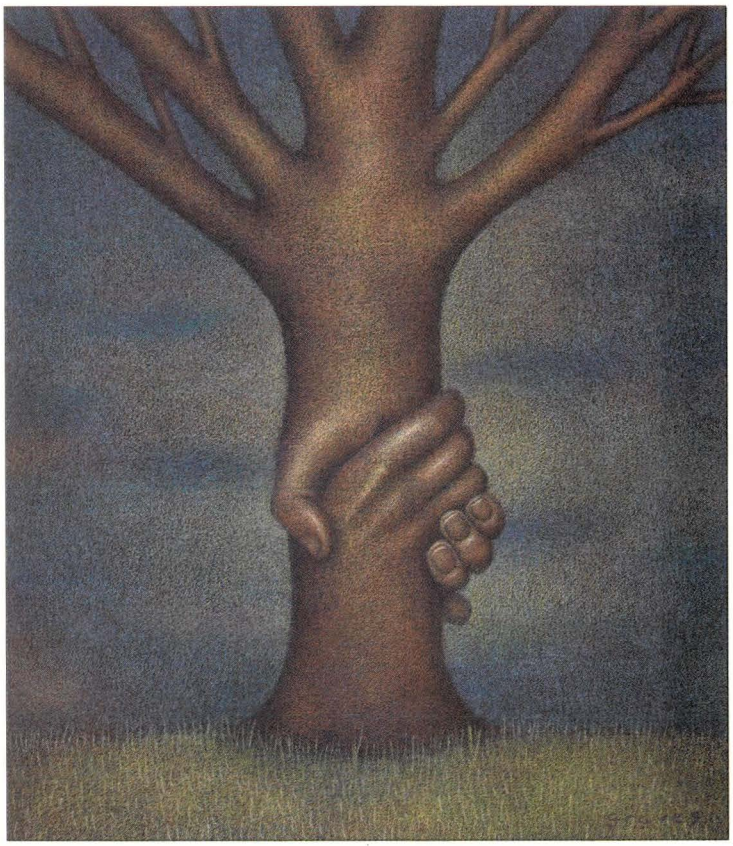

KEITH GRAVES

The Network File System

by PETER COLLINSON,
Hillside Systems

If you are a workstation user, then it's a good bet that part of your file store resides on another machine. You and the programs you run are not particularly aware of this–unless, of course, the other machine goes down for some reason. The programs access the other machine invisibly using NFS–the Network File System. NFS is part of daily life and you probably take it for granted. You access files on remote machines by joining their file system to yours and use normal UNIX commands to access the files and directories found there.

The whole NFS idea is an extension of the normal way that UNIX adds new disks to expand the file system. Each new disk (or disk partition) will contain a tree-structured file system with its own root directory, subdirectories and files. When you want to add a new disk onto an existing system, you add it as a branch from somewhere in the tree that is already established. You pick a mount point, a directory somewhere on your system and execute the `mount` command. Perhaps:

```
% mount /dev/sd0g /usr
```

This tells the system to read the disk partition `/dev/sd0g` and mount it on top of the `/usr` directory. The existing contents of the `/usr` directory apparently vanish, since whenever you attempt to access the directory, the kernel will arrange for you to jump into the root directory of `/dev/sd0g`. So, when you move into `/usr` using `cd` and type `ls`, you will see the contents of the root directory of `/dev/sd0g` and not the previous contents of `/usr`.

You are not aware of the "join" at the mount point; the kernel takes care of things for you so that the jump from one device to another is invisible. Similarly, the kernel works hard to ensure that correct things happen when you move up toward the root using the *dot-dot* construction. If you change directory into `/usr` and then back up again with

```
% cd ..
```

then you will find yourself at `/`, the correct place in the filesystem.

Mounts over Networks

The network file system takes the idea of mounting and permits you to mount a file system from a remote machine. The file system is not physically connected to the local machine, and it is not accessed using the conventional disk I/O routines. Instead, access requests for the remote disk are

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sent over the network to a server on the remote machine. The server will respond to the local machine with the data. In this situation, we refer to the local machine as the *client*.

Now, you mustn't run away with the idea that Sun was responsible for the invention of remote file systems. I recall vividly when the idea was explained to me: It was at the University of Newcastle, United Kingdom, in the early 1980s. Lindsay Marshall had created a system that became known as the Newcastle Connection. The software constructed a single filesystem from several PDP-11 machines running UNIX. It was done by replacing the standard C-library routines for file access with code that trapped remote access and emitted requests over the network to servers. The client code all existed in user space. Some of this was design expediency: Lindsay could work on systems that were in use by others. Some was design constraint: The PDP-11 kernel was limited in size. Later versions of the client code were put into kernels.

When the Newcastle Connection was explained to me, it was one of those eureka moments: The world changed forever. There is something odd about a good, simple idea. Once it is explained to you, you can never understand why you had not thought of it before. But you didn't. Someone else did. Lindsay does not claim to have invented remote file systems. There were several groups that had the idea at around the same time.

A key building block for network file systems is the notion of remote procedure calls, or RPCs. If you find the term "procedure" odd, then just think "function" or "routine returning a result." A regular procedure is called by one module of a program, executes and returns a value to the calling code. A remote procedure call is executed by a module on one machine, the call and its parameters are wrapped in a message and it is fired over some network to a server on another machine. The server executes the requested action and usually returns some reply to the client–if only a response saying "done." This reply is picked up and returned to the calling routine.

Lindsay used this idea for the Newcastle Connection. Rather than the normal system calls being executed on the local machine, they were packed up into a message and dispatched to a remote machine. A server on the remote machine executed the system call and returned the result to the client. The user program continued executing, none the wiser about the way that the result was achieved.

Lindsay used the regular system-call interface as a way of interfacing to a network file system. There are other layers in the kernel that you might choose to add the code that says: "yup, this request needs to be sent to another machine."

At the lowest level in the kernel, it's possible and relatively easy to write a device driver for a remote disk. Disk device drivers take I/O requests from higher levels in the kernel and ship bytes between the machine and a set of magnetic surfaces. There is no reason why I/O requests cannot be passed to a server on a remote machine.

The job of this server is simple. It just takes commands from the network and performs reads or writes to its local disk. The server deals with a sequence of blocks and gets requests like "get me block 1345" or "write this to block 892654." These blocks can be a regular disk partition accessed through the raw character interface or can be mapped onto a single file in the file system.

The problem with this scheme is that disk-block handling is at a very low level in the kernel. It is below the normal code that deals with the file system, coping with directories and the relatively complex structure of files. All these code layers were designed with the idea that only one machine would be accessing the blocks on the disk. The structures used to create the file system on the disk do not lend themselves to being manipulated by more than one CPU. For safety, only one CPU should write to the file system.

When the Newcastle Connection was explained to me, it was one of those eureka moments: The world changed forever.

However, if the disk does not change (or changes rarely) then it is possible to mount the file system read-only on several machines. I did this once in the days when networking at my site meant Cambridge Ring technology and not Ethernet. We used the shared file system for the manual pages. It was a saving to share the manual pages since we ran the same operating system on all our machines. The shared file system was mounted read-only on all machines that accessed the disk via the network. The machine that actually owned the file system was allowed to change it.

The shared file system idea worked–most of the time. There were occasional problems caused when new files were created. This could change the use of blocks on the disk, and these blocks were sometimes sitting in read caches on machines on the network. The remedy was to remount all the remote file systems on the client machines.

Vnodes

Anyway, many people did these types of experiments. Most came to the conclusion that to make a correctly functioning remote file system it was necessary to identify a layer in the kernel that could take a user request for some activity on a file and decide either to deal with it locally or pass it to some remote machine using RPC.

The group that was originally responsible for UNIX, the Research Group in Bell Labs, decided that the "file system" was the correct level to provide a switch. They created RFS, the Remote File System.

A group in Sun decided that the file within the file system was the correct level and created NFS. Each file in a file system on a disk is referred to by its inode (or index node) number. These inodes contain all the information that you will see on the output from `ls -l`: the ownership, access modes, times, etc. The inode also contains block informa-

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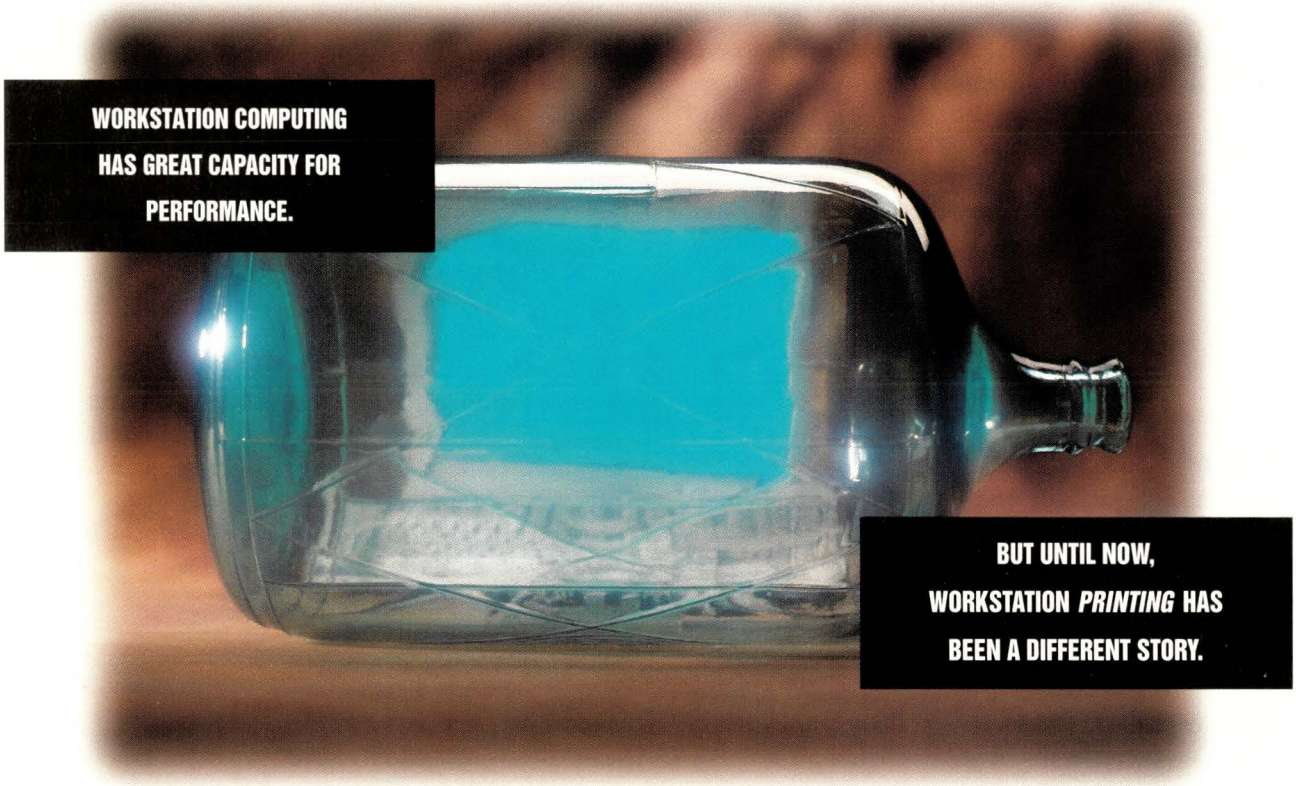

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tion about where the file contents are to be found on the disk. When a file is accessed, the inode is brought into memory and stays around for as long as is needed.

The idea is to augment the in-memory version of the inode by all the additional information that characterizes whether the inode refers to a file on the local disk or to a file sitting on another machine. Sun calls this structure the `vnode`, with the "v" standing for *virtual.*

As time has gone on, the "virtual" has come to mean "virtual file system" using `vnodes` to reach files over the network, files on DOS formatted floppy disks and files on CD-ROMs written in High Sierra format, or more recently written in High Sierra format with Rock Ridge extensions. All these different file systems can "look" like a standard UNIX file system (nearly–there are *some* differences) to the set of user programs running on the machine.

One other benefit of the vnode idea is that it is possible to mount an arbitrary directory from one machine onto the mount point of another. You are not limited by the physical layout of the server. This has distinct benefits. You can mount just a portion of a server's file system, `/usr/man` for example.

XDR and RPC

It's wrong to think that NFS is a file system definition. It's really a network protocol that defines a set of operations that can pass between a client wanting access to files and a server providing a shareable file system. A very early aim of NFS was that the protocol should be able to connect many different types of clients. A server should not be restricted to supporting UNIX machines. The protocol should also be simple enough to be implemented on PC systems.

If this is an aim, then you need a way of moving data between machines so that a character remains a character, an integer remains an integer, a string is recognizable as a string and so on. Of course, the machines all like to be different. For example, the designers can choose which way round the machines should store their integers. To ensure that all machines can talk to all other machines, Sun designed and implemented a portable data representation called XDR (eXternal Data Representation). To promote the standard, Sun also gave implementations away on the Usenet network.

What is XDR? First, it's a Draconian set of decisions about byte ordering. It assumes that all machines can deal with an 8-bit entity that we like to call a byte. All other data types are created from bytes, so 32-bit integers are expressed as four bytes, with the first byte containing the most significant part of the number. If your machine doesn't support this ordering, then so sorry–you must swap the order. XDR supports a wide range of available data types, reflecting the need to ship complex structures from a C program on one machine to a C program on another.

Secondly, XDR is a data description language. You write specifications in the language that is a bit like C (not surprisingly) and the specification is moved to another machine. However, most programmers do not see this. They use a set of standard library routines to import or export data.

XDR is not a protocol. It defines the way data is exchanged between machines. By itself, it's not enough to provide a base layer for a client/server network file system. You need a standard way of conveying remote procedure calls between machines. Sun thought this too. At the same time that XDR was delivered to the world, Sun gave away its own RPC. It's a classic lesson on how to create something that everyone uses.

Another reason for its success was an early realization that it was better to build many little protocols to do specific tasks as the need arose. The usual alternative is to make one huge monolithic protocol that takes an age to design and a monster machine to run. If you like, Sun applied the UNIX approach to protocol design.

The RPC layer is just a way for a client to send a request to a server and get a response back. It's a basic primitive. Other protocols are used to bind clients to services. The portmapper is a good example of this.

The job of the portmapper is to hand out the port numbers that address particular services on your machine. This means that you only need to burn a single port number, the port number of the portmapper, into the system. A client will send to that well-known port with the name and version of the program that it wants to use. The portmapper will hand out the real port to be used, and all later RPC calls for that program will use that port. There is a specialized protocol for talking to the portmapper. It uses RPC as a primitive.

The NFS Protocol

The NFS protocol uses RPC to convey a set of procedures, their arguments and results. The procedures define the actions that are requested by a client from a server. The protocol is stateless. Each remote procedure call is atomic, containing all the information needed to complete the call. The server does not retain any state for the client.

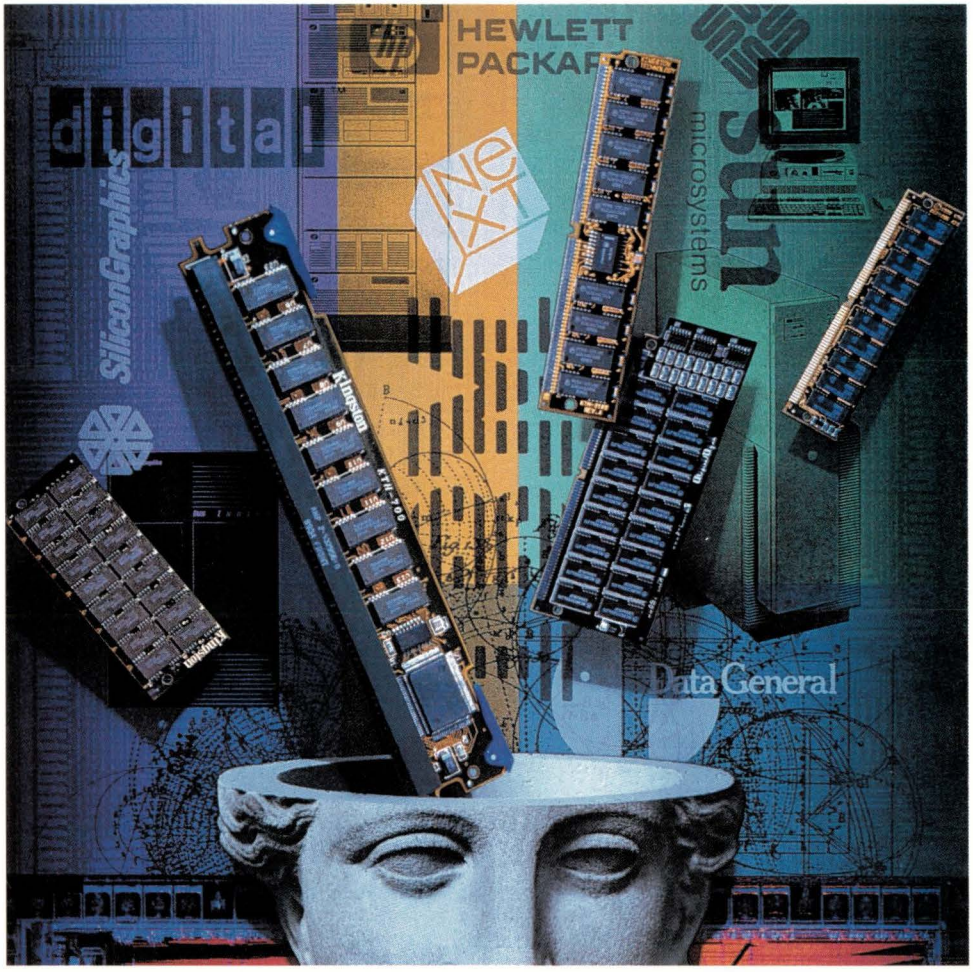
This statelessness is a mixed blessing. There are things in the UNIX file system that need state. File locking was missing from NFS-mounted file systems for several years until Sun created a working locking protocol.

The idea is that statelessness aids crash recovery. If a server crashes, then clients keep sending requests for data until the server is put up again. If the client crashes, then resynchronization procedures are not needed in the server.

I expect that most of you have been around when some central server has gone down and everyone's system has just simply stopped because it cannot get access to some crucial file. There was a time you had to be careful about mount points because a dead server could result in users being stuck in something innocuous like `df`. When I say stuck, I really mean stopped from doing anything at all. Attempts to kill the `df` process would fail.

The reason for this is simple. The `df` process has caused the kernel to send an RPC request to another machine and is blocked until the reply comes. The process ignores signals because it is in this waiting state. The reply never comes because the server is down.

These problems have lead to the development of "soft mounting," the ability to break out from RPC send/receive



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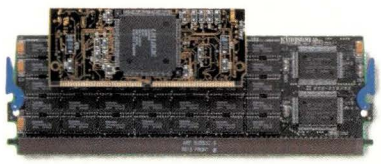

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sequences. This is done at the expense of data integrity. Errors will be returned to clients if the server does not respond. This is not really UNIX file system semantics.

I remain unconvinced by the worth of statelessness. If you string a virtual circuit between client and server, then you get an immediate indication that one side has disappeared unexpectedly. It's then possible to take recovery actions. The argument has always been that you should use datagrams for the RPC for speed, and hence RPC for NFS runs on the UDP protocol. Trouble is, you then need to worry about reliability. The UDP-based systems are forced to generate their own reliable connections, reinventing the reliability that TCP/IP would give you.

RPC also runs over TCP, so why not just use that? Again, I guess the answer is speed. However, the folks at University of California, Berkeley, have generated an implementation of NFS that runs on TCP. It does just as well as the parallel UDP-based implementation. Let's move from this religious issue.

The NFS protocol has a bunch of primitive operations on files and directories. Directories are treated as being different from files and are provided with their own operations. This means that NFS does not force the server to have a particular idea of how directories and files should behave. As long as the server understands that a directory can contain files and directories, then NFS will work. For instance, the protocol does not handle complex path names. The client must take a path name apart piece by piece to search the directories on the server.

Most basic operations work by using the notion of handles. This is a reference that uniquely identifies the file on the server. To read a file, the client will first get a handle by using the `lookup` operation, quoting a directory handle and a name. Once the client has a handle to the file, it can issue read instructions to obtain data. There is no close operation. The client simply forgets the handle.

It's the job of the mount protocol to furnish the client with the handle of the first directory. Again, the mount protocol is separate from the main flow of things. This allows different mount actions to be taken, depending on the client and server. For example, the PC-NFS mount protocol for workstation servers asks the PC user for a password.

NFS and SunOS

A critical part of the file store is that files and directories are owned by someone. Ownership combined with access

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permission allows individual users to control access to their files. We need to ensure that this is maintained for the network file system.

Sun RPC permits different authentication methods. Since the creation of NFS, each RPC message has carried the UNIX-style identification block containing the source machine-name, user-id, group-id, etc. The problem is that all connected systems must have the same uid/gid space. Somehow, we all seem to put up with this, although it's a pain.

There is a problem with root access too. Traditionally, root has uid zero and the ability to access any file on the system. Although we seem prepared to share a uid space, we are certainly not going to have that idiot super-user that lives next door interfering with the machine. The default case is that servers change any root access in the RPC from uid zero to the uid of the `nobody` user, usually -2. This can mean that root has less privilege on a server than mortals.

Also, if we own a machine, we don't want to permit the world to mount our filesystems. We want to control who can do this. The mount protocol is responsible for allowing or denying access and is controlled by `/etc/exports`. This file exists on the server and contains the directories on that machine that can be remotely mounted, which machine can mount them and under what circumstances (for example: read-only with no root access). It's possible to allow access to the world by not being specific in this file, but this is a bad idea. You are not sure who the world is and what they will do when invited in. These days the information is `/etc/exports` is kept in the kernel and a command `/etc/exportfs` must be run whenever the file information is altered.

Security on NFS is still a problem. Sun has put some some work into using DES authentication and generating a new "secure" protocol. Unfortunately, the contents of files are still passing over networks in unencrypted form awaiting the electronic eavesdropper.

Reading

Most of this article has been derived from documents found on the AnswerBook CD-ROM. Look at "Developer's Set/Network Programming Set/Network Interfaces Programmer's Guide."

Some of this article was derived from a paper presented by Russel Sandberg at the EUUG Conference in Florence, Italy, Spring 1986.

The XDR specification is RFC 1014. The NFS protocol spec is RFC 1060. These should be available on an archive server near you. ⊸

Peter Collinson runs his own UNIX consultancy, dedicated to earning enough money to allow him to pursue his own interests; doing whatever, whenever, where ever... He writes, teaches, consults and programs using SunOS running on a SPARCstation 1+. He is the Usenix Standards Liaison. Email: `pc@expert.com`.

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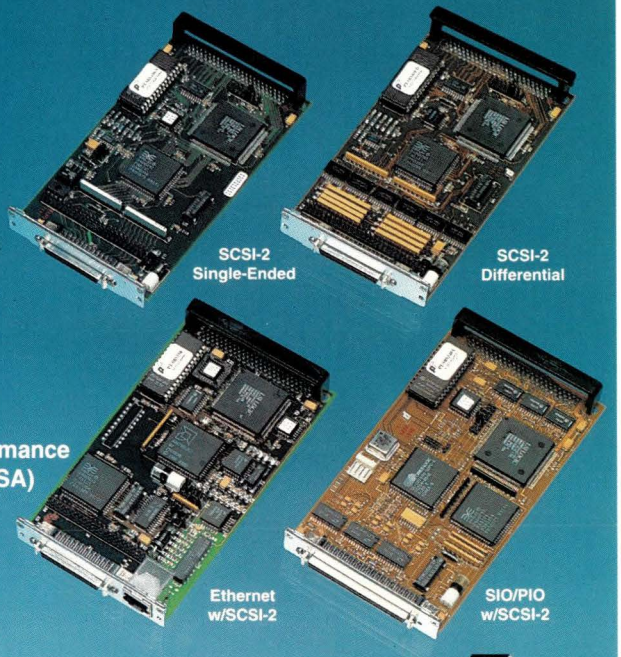

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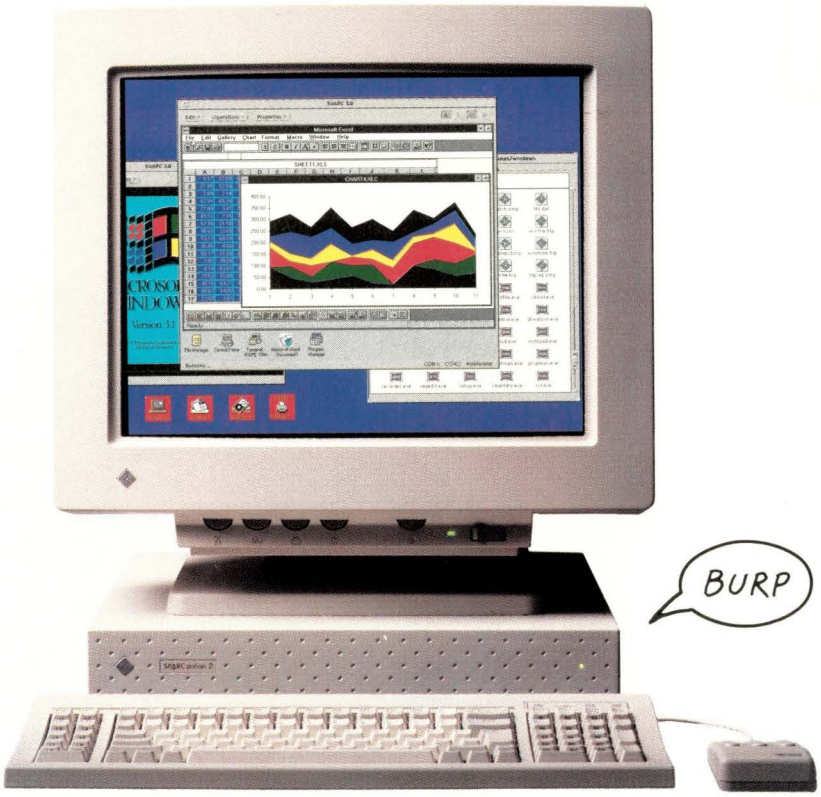

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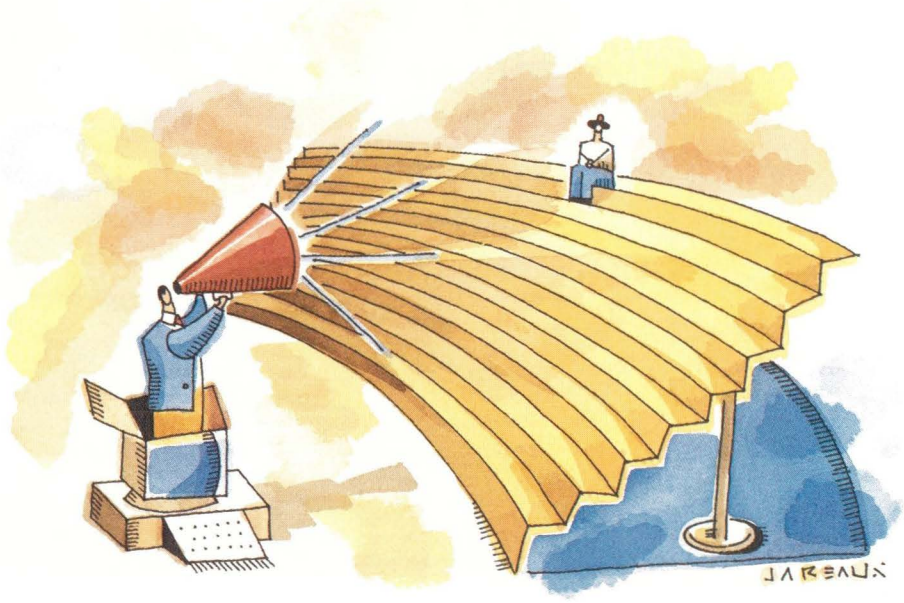
I/Opener



ROBIN JAREAUX

by RICHARD MORIN,
Technical Editor

A Guide to Workstation Hardware (Part 2)

The shouting seems to have died down a bit in the BSDI/CSRG/USL wars. Let's look at hardware a bit more while we wait for new events to transpire. (Or at least to become visible to public scrutiny...)

In this column, as promised, I propose to say a few words about some of the more esoteric aspects of cabling: impedance matching, termination, etc. I will also take a shot at some of the active devices found on networks: bridges, routers, gateways, etc. Please let me know if there are any specific hardware topics you would like to see covered–a follow-on article is always a possibility.

Impedance Matching

Let's say you're standing in the middle of a stadium. If you shout, no matter how hard, folks in the stands will have a hard time hearing you. The high pressures you emit don't move enough air to carry much sound.

For this reason, along with directionality, cheerleaders use megaphones. The horn converts small amounts of air moving at high pressure into larger amounts at lower pressure. This is a better match to the impedance of the air in the stadium, and the sound carries up into the bleachers.

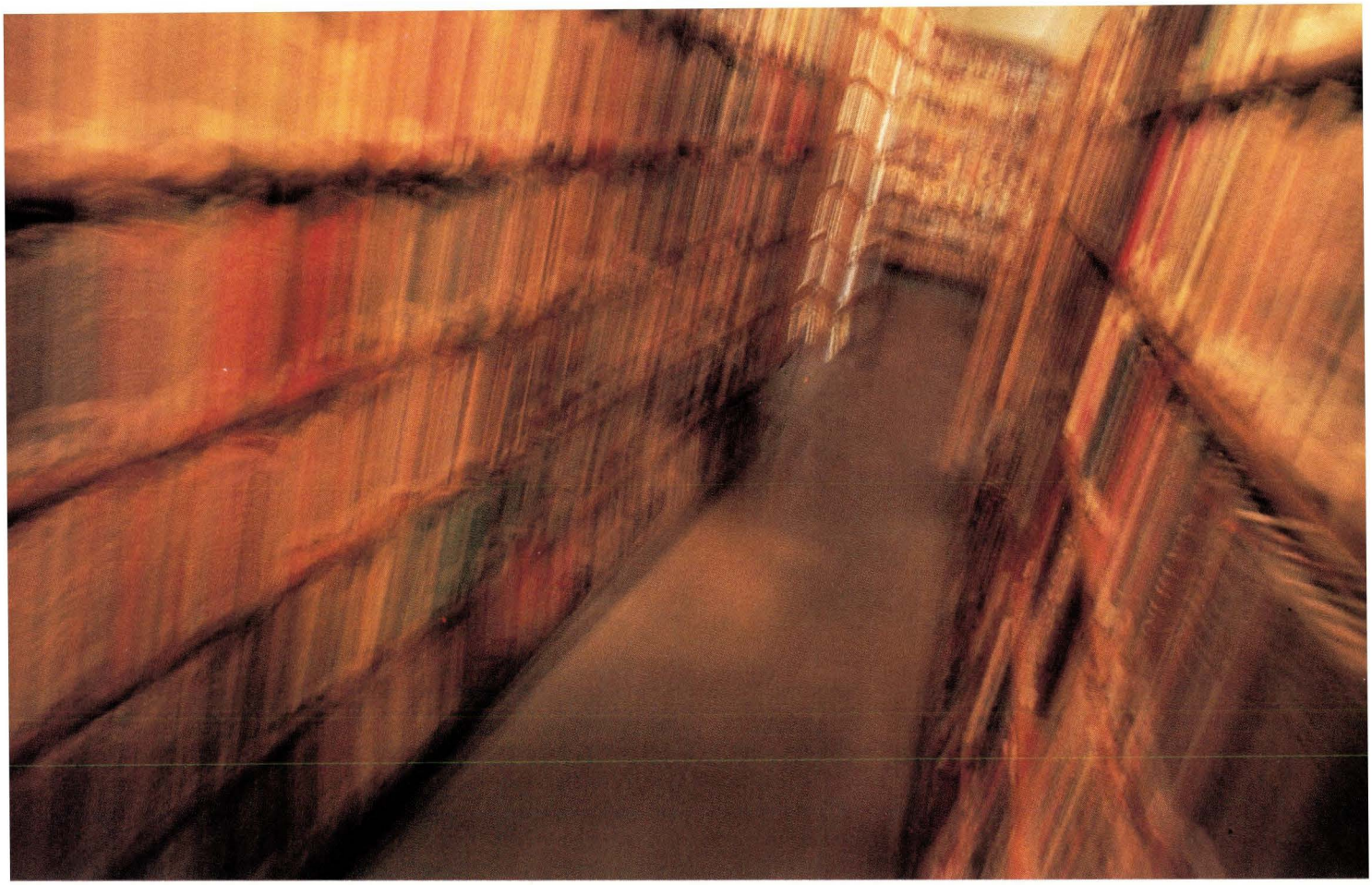
Impedance matching is also important to certain kinds of electrical circuits. Ethernet cable, for instance, is specified to have an impedance of 50 ohms. The exact meaning of this value is a bit mystical, but we can (and will) ignore it. The key fact is that cables with improper or inconsistent impedances can be very detrimental to the quality of your network.

It isn't hard to get things right; standard Ethernet cables and connectors are all designed to match the 50-ohm standard. I managed to get in trouble on this very issue a while back, however. I needed to lash together several machines in my lab, and I had some handy coax on hand, complete with BNC connectors.

Worked fine, too, until I added a longer run at the end of the string. Suddenly, everything stopped working. I checked for shorts and open circuits; no luck. Turns out the cables I used had wildly inappropriate impedances and were causing all sorts of reflections. I pulled them out, and the net started working properly.

In point of fact, even my current network might fail if extended for several hundred feet. My cables are somewhat of a grab bag. Proper Ethernet cable, in contrast, is pretty fancy stuff. Close physical (e.g., diameter) and electrical (e.g., resistance) characteristics must be maintained over the entire length of the net.

Otherwise, the network will suffer from micro-reflections, which will show up as noise, degrading the reliability of the network. Older cable TV



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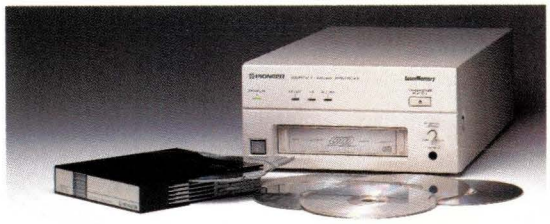

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systems, incidentally, tend to have such noise. It shows up as smearing and ghosting of the picture.

Reflections and Termination

To understand why this happens, let's go back to the stadium. Equipped with your handy megaphone, you shout toward the bleachers: "Shift to the left! Shift to the right! Pop up, push down, byte, byte, byte!" (Unknown, `fortunes(1)`).

If the bleachers are concrete, you will notice some sounds being reflected back to you. The sound waves, going from air to concrete, are unable to get it moving very much. Instead, they bounce off and reflect back to you.

If you shout down a properly designed corridor, you won't get an echo. The sound will slide down the corridor, past any listeners and die out at the end. Add some lumps and bumps, however, and your message will get distorted by echoes (reflections). Add a hard wall at the end, and you may cause substantial problems.

In a network (bus, etc.) this can be very detrimental. Bits are supposed to go out to the ends of the network cabling and quietly drop off the ends. If they bounce back, they can interfere with following bits. "How does that happen?" you may ask. (Aw, c'mon, ask!) Well, it has to do with c. Not C, the language; c, the speed of light: 300 million meters per second. Ready for some simple math?

An Ethernet carries data at about 10 million bits per second. This means that each bit has about 100 nanoseconds to do its thing. Multiply that by c, and you get a distance of 30 meters. Each bit travels this distance before the next bit emerges. Except that Ethernet (like most cabled systems) propagates signals at about two-thirds of c, so the distance is more like 20 meters.

If a reflection is practically instantaneous, it may enhance or diminish the volume of the signal, but it won't muddy it up much. Acoustically "live" rooms are very reflective but aren't much of a problem for listeners.

As the reflections get more delayed, however, they start to interfere with the signal. An echo-ridden auditorium is thus a real nuisance. Similarly, reflections caused by bad cabling can cause packets to be munged.

Solutions

All of this stuff is well understood by network hardware types. There are devices (terminators) that eliminate reflections at the ends of networks. Commercial cables and connectors are designed and fabricated to tight tolerances and shouldn't cause problems, if installed properly.

Nonetheless, cabling can go sour, and the problems generally won't be obvious on visual inspection. Replacing the entire network is an expensive solution, and may not even be possible. Fortunately, there is a nifty (if somewhat expensive) gadget that can find bad cables and connectors, pinpointing their position within inches.

This gadget, a Time-Domain Reflectometer (TDR), is a signal generator coupled to a very fast recorder. It emits a sharp pulse, then observes reflections. The time taken for each reflection gives away its distance from the TDR. Looking at a system map, one can then decide which ceiling panel to pull to get at the offending connector, etc.

There is no need to buy a TDR; just remember that they exist. If you need one, rent it, or hire a network wiz to come in and analyze your net with one. In fact, if you are on an older net that seems to be having noise problems, a TDR analysis might be a useful diagnostic measure.

Segmented Networks

If a network gets too large, even the best possible cable won't save it. Ethernet uses "collision detection" to keep nodes from transmitting at the same time. This relies on the fact that two transmitting nodes can hear each other.

If a net gets too long, two nodes can be done transmitting short packets before hearing the other node begin. At intervening nodes, unfortunately, the bit streams collide, producing garbage. Worse, the transmitting machines have no knowledge that their bits are getting lost.

More to the point, large Sun networks tend to have a lot of NFS traffic, which is mostly local in nature. By keeping traffic among localized sets of machines off the entire net, one can free up room for "long-haul" messages. (Even short, densely populated networks can benefit from this technique.) In any case, there are frequently very good reasons for splitting networks up into segments.

There are many ways of doing this, however. If the problem is simply one of cable length, a "repeater" may be all that is needed. Repeaters receive packets from one network and retransmit them on others. In the process, any analog noise buildup is removed and any lost signal strength is restored.

Unfortunately, things aren't usually quite that simple. You many not want all the traffic to be repeated on both segments. Worse, a node may live on more than one segment of a network, and segments may be connected in more than one way. Consequently, bridges must be able to decide whether and how to forward packets. To do this, they remap the local area network (LAN) "mesh" of network segments into a "spanning tree:"

Algorhyme

I think that I will never see
A graph more lovely than a tree.

A tree whose crucial property
Is loop-free connectivity.

A tree that must be sure to span
So packets can reach every LAN.

First, the root must be selected.
By ID, it is elected.

Least cost paths from root are traced.
In the tree, these paths are placed.

A mesh is made by folks like me,
Then bridges find a spanning tree.

–Radia Perlman

All this automagical routing has its limits, however. If a bridge doesn't *know* that the destination is on the same side as the source, it has to pass along the packet. As the number of bridges increases, so does the percentage of traffic that has to go through each bridge, because each bridge knows about a smaller percentage of the total network.

A host of related complexities (covered in detail in Radia Perlman's book; see below) can cause bridges, and thus networks, to get confused. Various schemes have been proposed, developed, and deployed, but they all exhibit problems when networks grow large enough.

Routers, which are typically used to connect LANs to WANs (wide area networks), have a similar set of problems, magnified by the scale of their operation. Consequently, they have a higher-level set of protocols to help them figure out where packets should go.

The fundamental difference between repeaters, bridges and routers, in fact, lies in their level of operation. Repeaters work at the bit level; any bits they hear on one side, they repeat to the other. Bridges work at the next level up; they look at Ethernet addresses (the six-byte addresses ROMed into each machine) and try to decide what to do with the packet. Routers work at the next level above that; they look at the addresses in the transport protocol (e.g., IP) and try to decide what to do with the packet.

Since Ethernet addresses are vendor-assigned to each machine, they are essentially random by the time they get to a site. Consequently, a bridge must keep a list of *all* the machines it knows about, and look in that list to decide where to send a packet.

IP addresses, in contrast, are administrator-assigned to each machine. Generally, they are assigned so that all the addresses on a given segment match a certain pattern (e.g., 192.9.200.X). Thus a router only keeps track of *patterns* of addresses and how to reach those patterns, rather than all addreses involved.

Fortunately, none of this is much of a problem for administrators of small- and medium-scale networks. The commercial routers work, and the companies that sell them know how to set them up. If you have a large network, you can afford a network guru or two, who will handle the more esoteric problems you will encounter.

Suggested Reading

There are several books of relevance to this series of columns. For basic electrical and electronic lore, it is hard to beat *The ARRL Handbook for Radio Amateurs* (American Radio Relay League, annual). It's a substantial tome, and the price ($25) is amazingly low.

The Art of Electronics, 2nd. Ed. (Horowitz and Hill, Cambridge University Press, 1989, ISBN 0-521-37095-7) is another substantial tome. A lovely book, it covers a wealth of electronic topics in a very readable style. Finally, *Physics for Computer Science Students* (Garcia and Damask, Springer-Verlag, 1991, ISBN 0-387-97656-6) is a headlong jump into the theory of chip design, if you're interested.

Interconnections: Bridges and Routers (Perlman, Addison-Wesley, 1992, ISBN 0-201-56332-0) is a long-needed survey work on how segmented networks work. Part of Addison-Wesley's Professional Computing Series (Brian W. Kernighan, Consulting Editor), it has the quality and attention to detail that we have come to expect from Brian's editing efforts.

Acknowledgments

Thanks to the hardware and network jocks who looked over this column. Special thanks to Brent Chapman, of Great Circle Associates, for his extensive comments and contributions on segmented networks. Any remaining errors are, of course, their fault (;-). ⊸

Richard Morin produces Prime Time Freeware, a semi-annual CD-ROM collection of redistributable, UNIX-related source code. Between releases, he consults, writes and teaches on UNIX topics. He may be reached at Canta Forda Computer Laboratory, P.O. Box 1488, Pacifica, CA 94044 or by email at rdm@cfcl.com.

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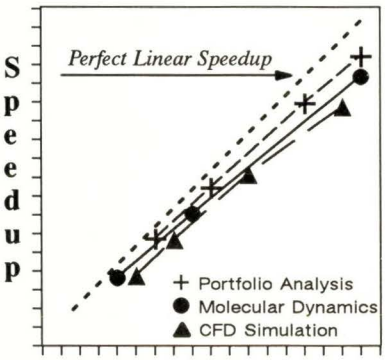

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Your Standard Column

JOHN W. KELLEY JR.

Mail Call

by PETER H. SALUS

Ever since the August (on the Gilmore-Gwyn exchange) and the September (on quality and availability) columns, my phone and email have been inundated with requests. As a result, I want to devote this column to a little news and some mail. There will also be a bit of humor, but you'll have to read the column to locate it.

Accessibility

First of all, sorry, you can't get the U.S. Government FIPS on-line: There is no FTP site. Copies of the Federal Information Processing Standards must be ordered from: National Technical Information Service (NTIS), U.S. Department of Commerce, Springfield, VA 22161. The phone number is (703) 487-4650; fax, (703) 321-8547; Telex, 89-9405.

On the other hand, one can find POSIX 1003.0, 1003.2, 1003.2a and 1003.2b in the anonymous ftp directory of `research.att.com`, under `netlib/posix`. In particular, `netlib/posix/p1003.2/d11.2` contains the whole of 1003.2 in sections, in both text and PostScript forms. While I have rarely said anything good about USL, AT&T Research has done a great service to the community by entering into this experiment with IEEE. My compliments to Andrew Hume, or whoever initiated this.

The following was posted on several of the WAIS groups. I think that this move on the part of the U.S. Government to make more information accessible is just great.

"As readers of this list may know, the GPO WINDO (HR 2772) and the GPO Gateway to Government (S 2813) would provide one-stop-shopping on-line access to federal government databases and and information systems. The service would be free to 1,400 federal depository libraries and available for subscriptions in homes and offices, priced at the incremental cost of disseminating the information. The service would be available through the Internet and over ordinary telephone lines using a modem. For more information, contact Anne Heanue, American Library Association (202) 547-4440; Bernadine Hoduski, Joint Committee on Printing (202) 224-5953; or James Love, Taxpayer Assets Project (609) 683-0534."

Activity

Well, boys and girls, at the July POSIX meetings, there was another Project Authorization Request: for a "Remote Operations Service Elements [= ROSE] API." A full report (by David Cannon of the University of Exeter) will appear among the POSIX reports in *;login:*, but it is incumbent upon me to point out the customary

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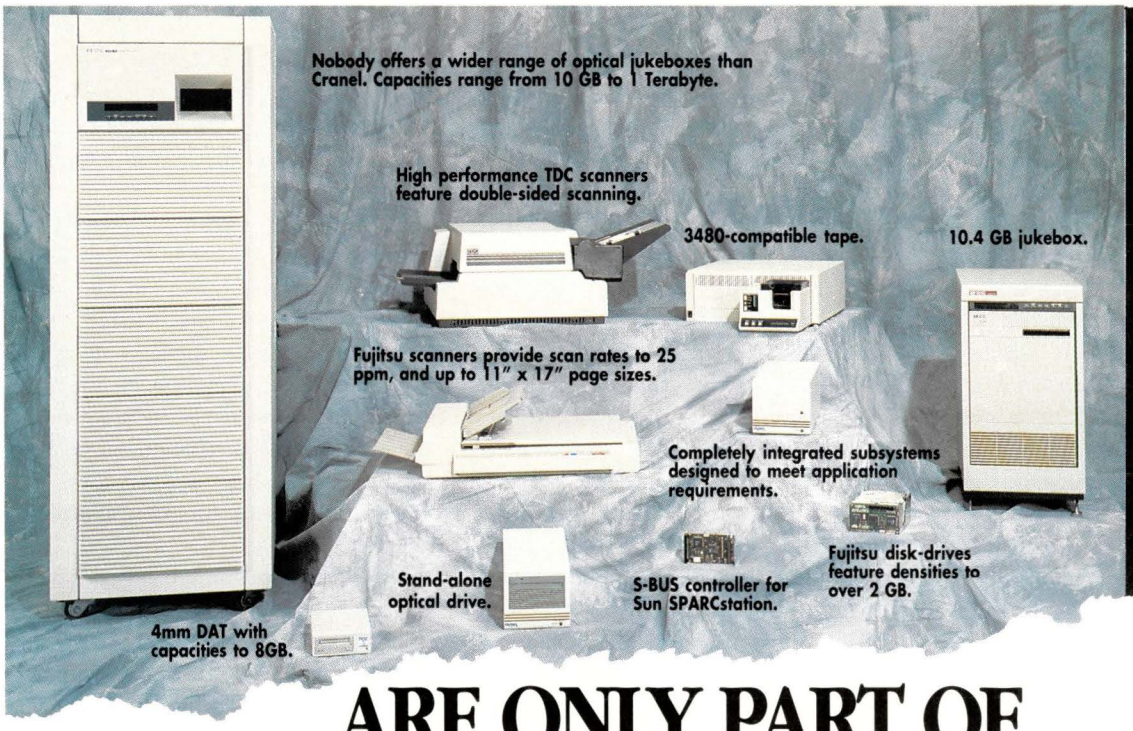

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proliferation of POSIX PARs and committees. The presentation was led by J.J. Cinecoe and Dan Shia. J.J. Cinecoe anticipated the obvious question: "Why do we need a ROSE API?'" Dan Shia described the Computing Environment on OSI (CEO), of which TROI is one component. The aim is to enable the construction of highly efficient distributed concurrent systems by providing a very thin API over the top of the protocol engine, and is based on OSI ACSE (Association Control Service Element), ROSE and ASN.1 (Abstract Syntax-Notation 1).

I don't have any printable comments on this OSI-oriented PAR. On the other hand, NISO, about which I wrote last December (1991), has been moving ahead. In April, Z39.72, CD-ROM Mastering, was published, as was a revision of Z39.2-1992, Information Interchange Format. To order NISO standards, phone (908) 932-2280 (Transaction Publishers; Rutgers–The State University).

Steve Trus has reported that the progress of the P1224 (Object Management API, based on X/Open's XOM) working group is very good. They expect the P1224 and P1224.1 (X.400 API) standards to be complete in early 1993. This facility will be used by P1003.17 (Directory Services API).

Feedback

In response to my August column, Henry Spencer (`henry@zoo.utoronto.ca`) has written to disagree with my comments on ANSI C:

"I'm afraid I have to disagree with the comments in your August column. (Note that I am not, and have not been, a member of X3J11.)

"Doug Gwyn is by no means alone in thinking that John Gilmore is mistaken. Doug basically has this one right: John's problem is that he's trying to build an ANSI C system out of components that were never designed for the job. It's not surprising that he's having trouble.

"More generally, the problem here is UNIX-centrism. Most UNIX C programmers have only really known one C compiler: Steve Johnson's PCC and its various derivatives. It never occurs to them that there might be other compilers in the world, which might do things differently. Therefore, they take any disagreement between PCC and ANSI C to be an evil botch invented by X3J11 out of sheer malice.

"In fact, with a few lamentable exceptions (trigraphs come to mind...), *everything* in ANSI C was in use in production C compilers before X3J11. The compatibility problems John is struggling with were not invented by X3J11. They were there already. X3J11's sin is that it has forced John to become aware of them.

"John is justifiably unhappy that the formerly serene UNIX C world is being invaded by constraints essentially imposed from outside. But it's what his customers want. If they ask for an ANSI C compiler, it's because they want a C environment that's compatible with the whole C world, not just the UNIX part of it. Like it or not, that means changes. The rest of the C world wasn't going to accept PCC's peculiarities and mistakes as the universal standard; to get consensus on a single C standard, some compromises were necessary.

"On the whole, X3J11 did a remarkably good job of producing a decent standard out of a chaotic mess of divergent variants. Of course it doesn't please everyone; most C users would prefer that the standard exactly match *their* compiler's way of doing things, so everybody *else* would have to do the painful adapting. The trouble is, "everybody else" wouldn't stand for it. So we all get to suffer a bit in the name of compatibility and progress. I'm afraid that people who try to build an ANSI environment out of non-ANSI pieces are letting themselves in for a lot of suffering."

Cay Horstmann of San Jose State (`horstman@sjsumcs.sjsu.edu`) also disagreed with me: "You called Doug's comments vituperative? Well, I found John's positively ranting.

"I have no connection with the ANSI committee whatsoever and am merely a happy user of ANSI C. For me, ANSI C has been a true blessing. I was able to switch compilers among several different vendors when one of them came up with a better product (e.g., better code generation, faster compile, better integrated environment). Even a large project would port in an hour or so.

"ANSI C's function prototypes have saved me from countless dreadful debugging sessions. No, I am not perfect and am apt to rearrange the arguments in `fread`. Having the choice of a failed compile or a core dump, I take the compiler error any time.

"Doug is absolutely right: If you wish to work with all ancient versions of old header files, don't use ANSI. It wasn't built for that.

"In summary: The ANSI committee made two decisions that were both technically sound and courageous: (1)

Lexicon

Geoff Collyer has sent me the following list of words for a future standards dictionary. He and Mark Moraes get my thanks for easing the burdens of a standards maven.

ansitize, v.: to pollute code; converse of sanitize.
[related terms: ansitization, ansitized, ansitizer] – *Geoff Collyer*

posixiate, v.: to kill code or render it unconscious. See asphyxiate
[related terms: posixiation, posixiated, posixiator] – *Mark Moraes*

svindle, v.: to rob someone of code, remove functionality
[related terms: svindle, n., svindled, svindler] – *Ian Darwin*

ISO-late, v.: to delay production of code, to slow down code.
[related terms: ISOlation, ISOlated, ISOlator] – *Geoff and Mark*

OSIfy, v.: To make code impenetrable. – *Geoff and Mark*

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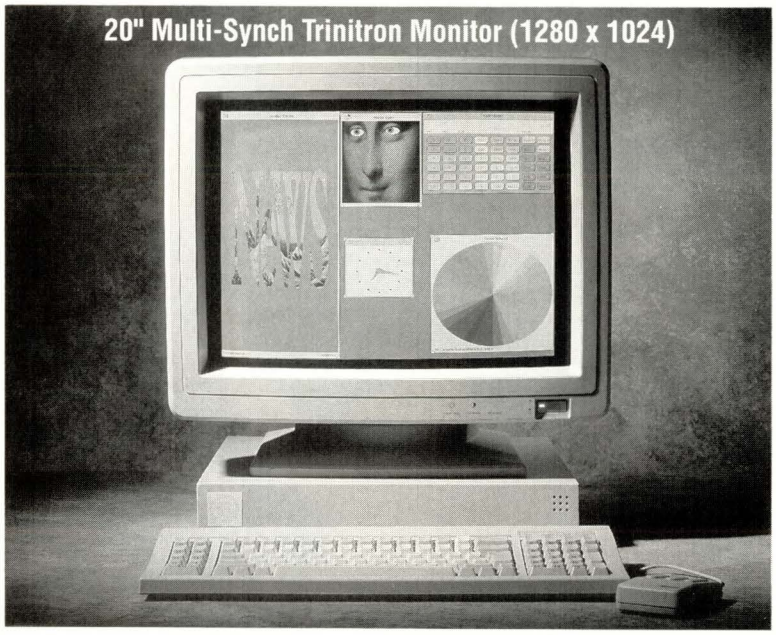

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Recognize that the standard library needs to be standard, and (2) Strengthen the type checking with function prototypes.

"Contrast their courage with the spinelessness of another committee that *was* beholden to narrow commercial interests: the SQL ANSI committee. It protected the then state of the commerce (*not* state of the art) and gave up on a single standard. All SQL users are worse off for it.

"Indeed, strong standards force a somewhat painful state of transition, but once you are over the hump, it is well worth it."

On the other hand, I got the following from Skip Montanaro (montanaro@crd.ge.com):

"I enjoyed your latest column recounting the exchange between John Gilmore and Doug Gwyn. Like Gilmore, we are stuck for the time being with one foot on the dock (K&R) and one on the boat (ANSI). For the time being, the boat is holding steady, but I anticipate that when we upgrade to Solaris, the boat will suddenly move away from the dock and we'll have to make the jump to the boat."

Finally, on this topic, one reader (who requests that I withhold both name and employer) wrote:

"Only someone working for a government could offer the suggestion, 'replace the non-conforming environments.'

"Right. Successful companies understand that their success rests on satisfying the needs of their customers, not policing political correctness as dictated by some committee of people with nothing better to do than to go to committee meetings and confound people doing real work. Vendors *must* support their users; government employees, it seems, don't share that view.

As a customer of Mr. Gwyn's employer, his viewpoint is painfully apparent." ⊸

Peter H. Salus is the executive director of the Sun User Group. He has attended both ISO and P1003/P1201 meetings and expects remission of time in purgatory as a result. Email: peter@sug.org.

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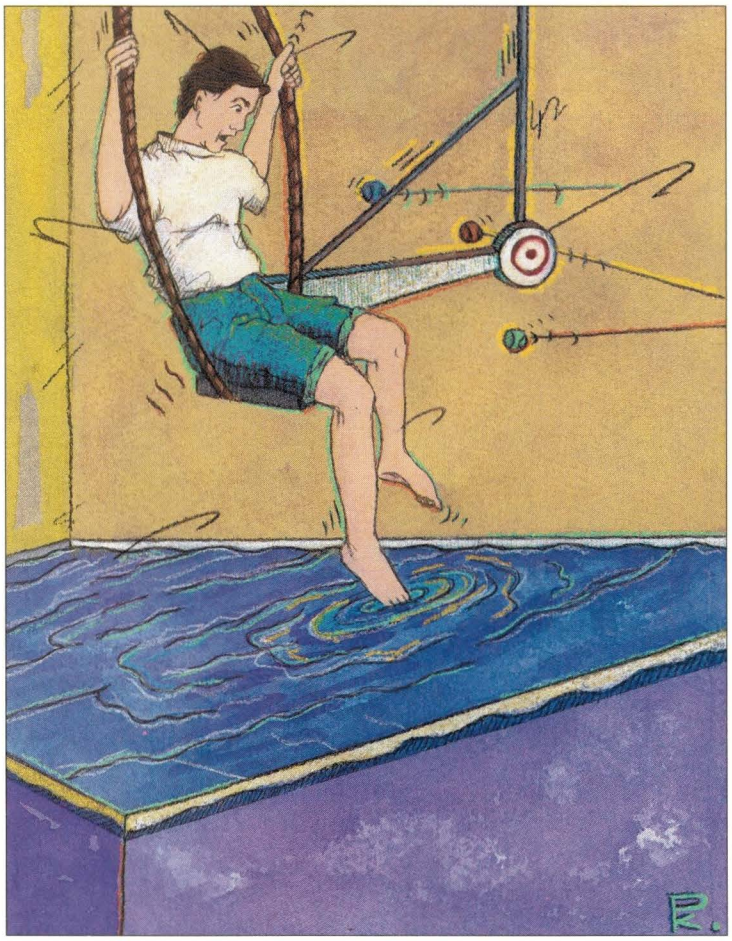

PETER KALABOKIS

Getting Your Feet Wet

by S. LEE HENRY

I sat staring at my screen. The message said "fasthalt: Command not found." Wait a minute, I objected. I haven't changed my path. Did I mistype? Wait. I'm running Solaris 2.0! Of course.

If you're holding out on Solaris 2.0 until you "have" to convert, you ought to consider this little problem. Old habits are hard to break, and quiet hours that you spend now cozying up to the new environment will pay off big time later. I suggest that all you holdouts consider dedicating a spare SPARCstation or some extra disk space. Due out during the first quarter of 1993, the *dot dot* release of Solaris 2.0 promises availability of Solaris 2.0 for the entire SPARC architecture and Intel systems as well.

Double Duty

If you can't afford to dedicate an entire system to learning Solaris 2.0, you might consider doing what I've done. Wizard, my little home SPARCstation 1+, houses both SunOS 4.1 and Solaris 2.0. This configuration allows me to explore Solaris 2.0, compare the contents of corresponding file systems, and get a gut feel for the familiar and the unfamiliar in the SVR4-based Solaris 2.0.

Wizard, a two-disk standalone, has a small (104-MB) internal disk and a larger (669-MB) external disk. Because the internal disk is so small and I know that two versions of operating systems take up considerable space, I partitioned Wizard to include two `/usr` partitions on my external disk. Figure 1 shows how Wizard is laid out. In order to boot the OS of choice, I merely have to select the proper form of the `boot` command. Since my root partition for SunOS 4.1.2 is the "a" partition on my internal disk, while the root for Solaris 2.0 is on the external disk, a simple "b" or `b sd(0,0,0)` brings up SunOS 4.1.2 and a `b sd(0,3,0)` boots under Solaris 2.0.

With mounts defined in the BSD `/etc/fstab` file and the SVR4 `/etc/vfstab` file, the "spare" partitions in either boot scenario can be mounted under names that signify the architecture to which they belong. While running Solaris 2.0, for example, I have SunOS 4.1's root and `/usr` partitions mounted as `/sunos41root` and `/sunos41usr`.

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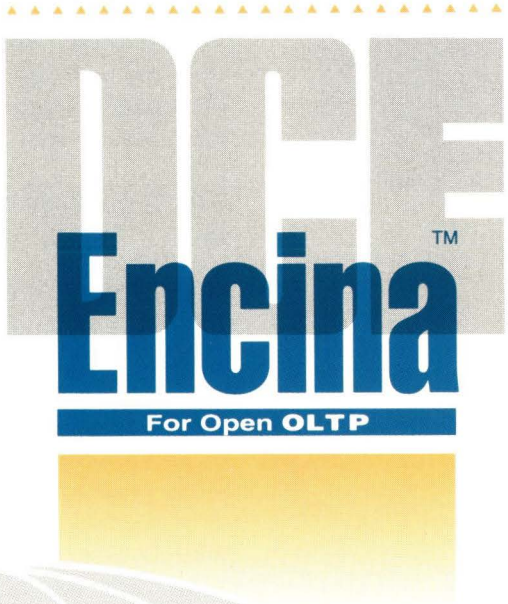

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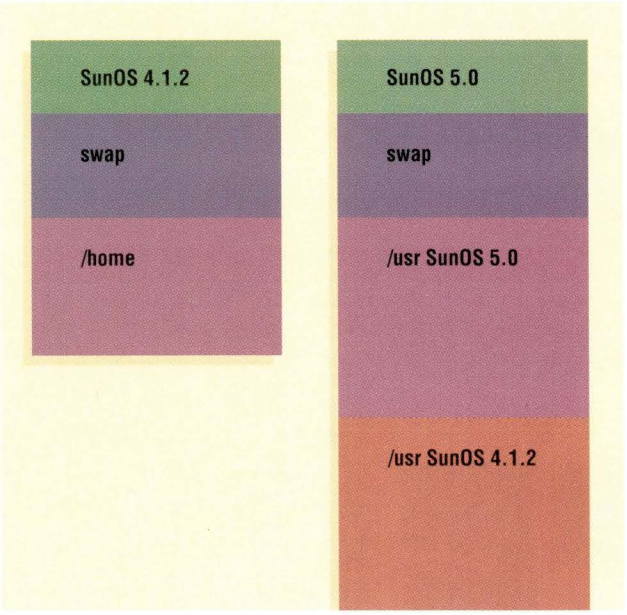


Figure 1. Wizard's Partitions

SunOS 4.1.2

```
/dev/sd0a / 4.2 rw,dev=0700 1 1
/dev/sd3h /usr 4.2 rw,dev=071f 1 2
/dev/sd0g /home 4.2 rw,dev=0706 1 6
```

SunOS 5.0

```
/dev/dsk/c0t0d0s0    /          ufs
       rw,suid       716578574
/dev/dsk/c0t0d0s6    /usr       ufs
       rw,suid       716578574
/proc  /proc         proc       rw,suid
       716578574 fd
/dev/fd              fd         rw,suid
       716578574
```

Figure 2. SunOS 4.1.2 /etc/mtab and SunOS 5.0 /etc/mnttab

Mount/Umount

The mount table and file system tables files are different in BSD and SVR4. The `/etc/mtab` file in SunOS 4.1 corresponds to the `/etc/mnttab` file in SVR4 (see Figure 2).

These files, which have a very similar appearance, contain information on currently mounted file systems. The mount command, when used without arguments, merely reads this file and formats the output for you. If you faked an entry like this:

```
/yo/slee /hello/there 4.2 rw,dev=1111 0 0
```

and added it to your `/etc/mtab` file, you'd see it like this:

```
/dev/sd0a on / type 4.2 (rw)
/dev/sd3h on /usr type 4.2 (rw)
/dev/sd0g on /home type 4.2 (rw)
/yo/slee on /hello/there type 4.2 (rw)
```

Don't do this except to convince yourself that it works this way.

What? /home Is Busy?

The first time I tried to mount `/home` on Wizard I got a message from `mount` that said:

```
mount: /dev/dsk/c0t3d3s6 is already mounted,
/home is a busy, or allowable number of
mount points exceeded
```

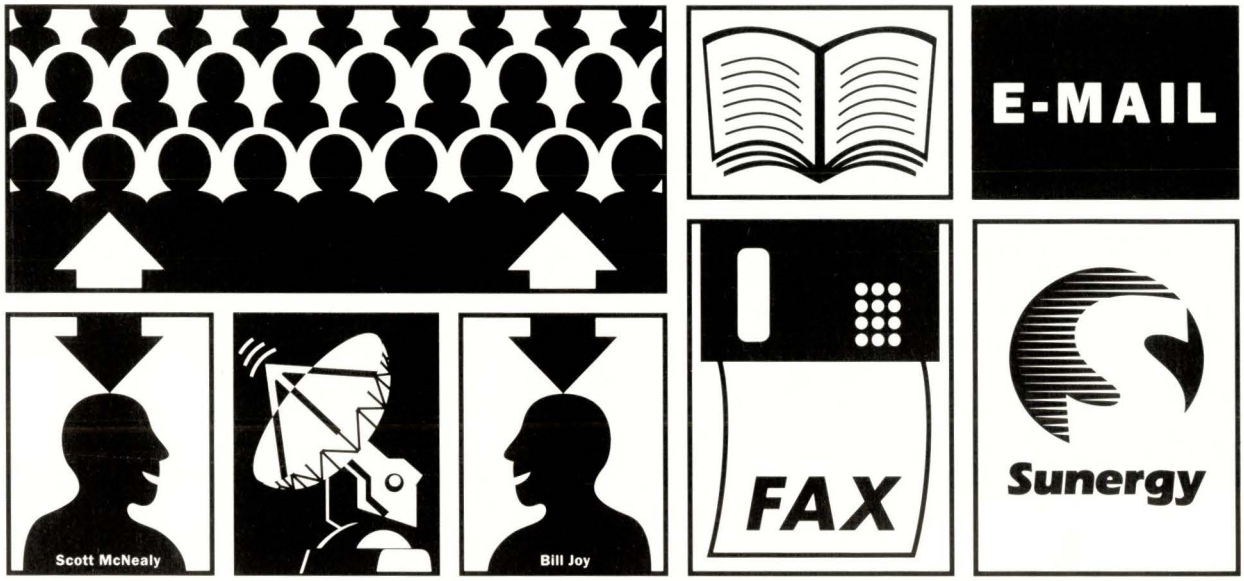
When I tried to remove the empty `/home` directory, I was told it was in use or was a mount point. A moment of puzzlement. Oh, yes. I get it. The automount process was running, and `/home` was defined as a default mount point. I remembered reading something about automount being preconfigured for certain directories and that `/home` was the new "preferred" location for home directories rather than the old preferred `/home/<hostname>`. Of course, to check to see automount running, the old `ps -aux` that I'd used every five or 10 minutes for years had to be replaced with the `ps -u root` command of SVR4. Show me root's processes, I commanded, and there it was, ready for slaughter.

Figure 3. Solaris 2.0 /etc/ufstab File

```
#device            device              mount    FS          fsck    mount       mount
#to mount          to fsck             point    type        pass    at boot     options
#
#/dev/dsk/c1d0s2   /dev/rdsk/c1d0s2    /usr     ufs         1       yes         -
/proc              -                   /proc    proc        -       no          -
fd                 -                   /dev/fd  fd          -       no          -
swap               -                   /tmp     tmpfs       -       yes         -

/dev/dsk/c0t0d0s0  /dev/rdsk/c0t0d0s0           /           ufs     1           no
/dev/dsk/c0t0d0s6  /dev/rdsk/c0t0d0s6           /usr        ufs     2           no
/dev/dsk/c0t0d0s7  /dev/rdsk/c0t0d0s7           /sunos41usr ufs     3           yes
/dev/dsk/c0t0d0s5  /dev/rdsk/c0t0d0s5           /opt        ufs     4           yes
/dev/dsk/c0t0d0s1  -                   -       swap        -       no          -
/dev/dsk/c0t3d3s0  /dev/rdsk/c0t3d3s0           /sunos41root ufs    -           no
/dev/dsk/c0t3d3s1  -                   -       swap        -       no          -
/dev/dsk/c0t3d3s6  /dev/rdsk/c0t3d3s6           /home       ufs     -           no
```

What do 1% of Sun users know that you don't?



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Disk Nomenclature

The mount error message also reminded me of the new nomenclature for disks. The c0t3d3s6 name represents controller zero, target three, disk three and partition 6 (which we think of as "g"). The `/dev` directory houses a number of subdirectories corresponding to different types of devices. The `/dev/dsk` and `/dev/rdsk` directories for disk and raw disk partitions, and pseudo for pseudo devices like windows are just two. The contents of these directories are pointers to subdirectories within `/devices` that contain the actual device files we're used to seeing in the old `/dev`. So...a complete entry for a disk partition on Wizard comprises the pointers in `/dev/dsk` and `/dev/rdsk`, the devices files in

```
/devices/sbus@1,f8000000/esp @0,800000
```

for the block and character devices themselves, the entry in `/etc/vfstab` file and the mount point. The devices files will look odd at first, but the names make a lot of sense:

```
sd@3,0:g sd@3,0:g,raw
```

It's certainly clear which is the raw device. Minor device numbers are also easy to determine. These can be calculated from the target and partition number as follows:

```
minor device number = ((target #) * 8) +\
        (partition #)
```

For partition "g" on target 3, the minor device number is 30. Notice that not everything in the `/etc/vfstab` file has to be mounted upon booting. The mount at boot option, if set to "no," leaves the file system ready for manual mounting.

The `mknod` command is the same. Only the device name (the first argument) is different. `mknod` commands for partition g look like this:

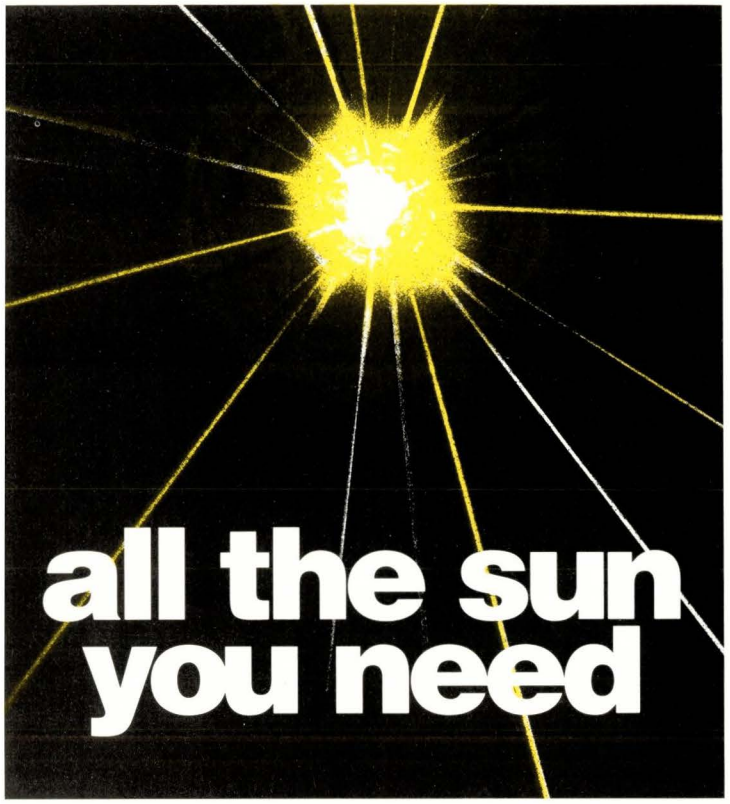
```
mknod sd@3,0:g b 32 30
mknod sd@3,0:g,raw c 32 30
```

Make It Easy

The most convincing argument for setting yourself up with Solaris 2.0 today is to anticipate changes and be up to speed before you convert on a large scale. I think you will find the differences to be much less traumatic if you give yourself a chance to explore Solaris 2.0 long before the pressure to convert has had a chance to build. You'll also find yourself in a better position to help your users if you give yourself a head start.

Don't neglect Sun's Solaris Transition Kit. The Pipeline tool document includes details on command changes and substitutions that will be very helpful while you are learning to "think SVR4." ⊸

S. Lee Henry is on the board of directors of the Sun User Group and is a systems administrator for a large network of Suns in the federal government. She also heads The Next Page Inc., which specializes in software documentation.



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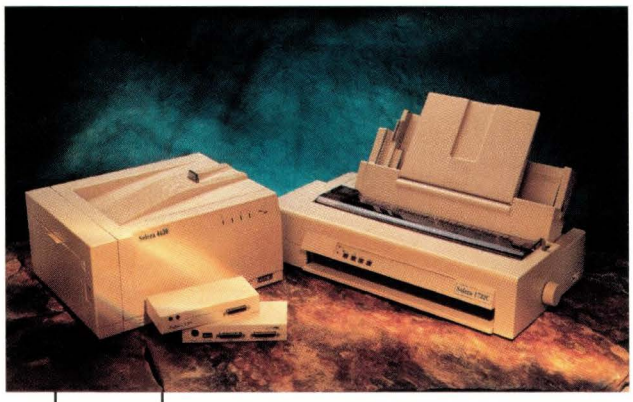

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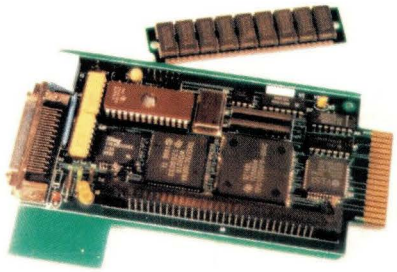

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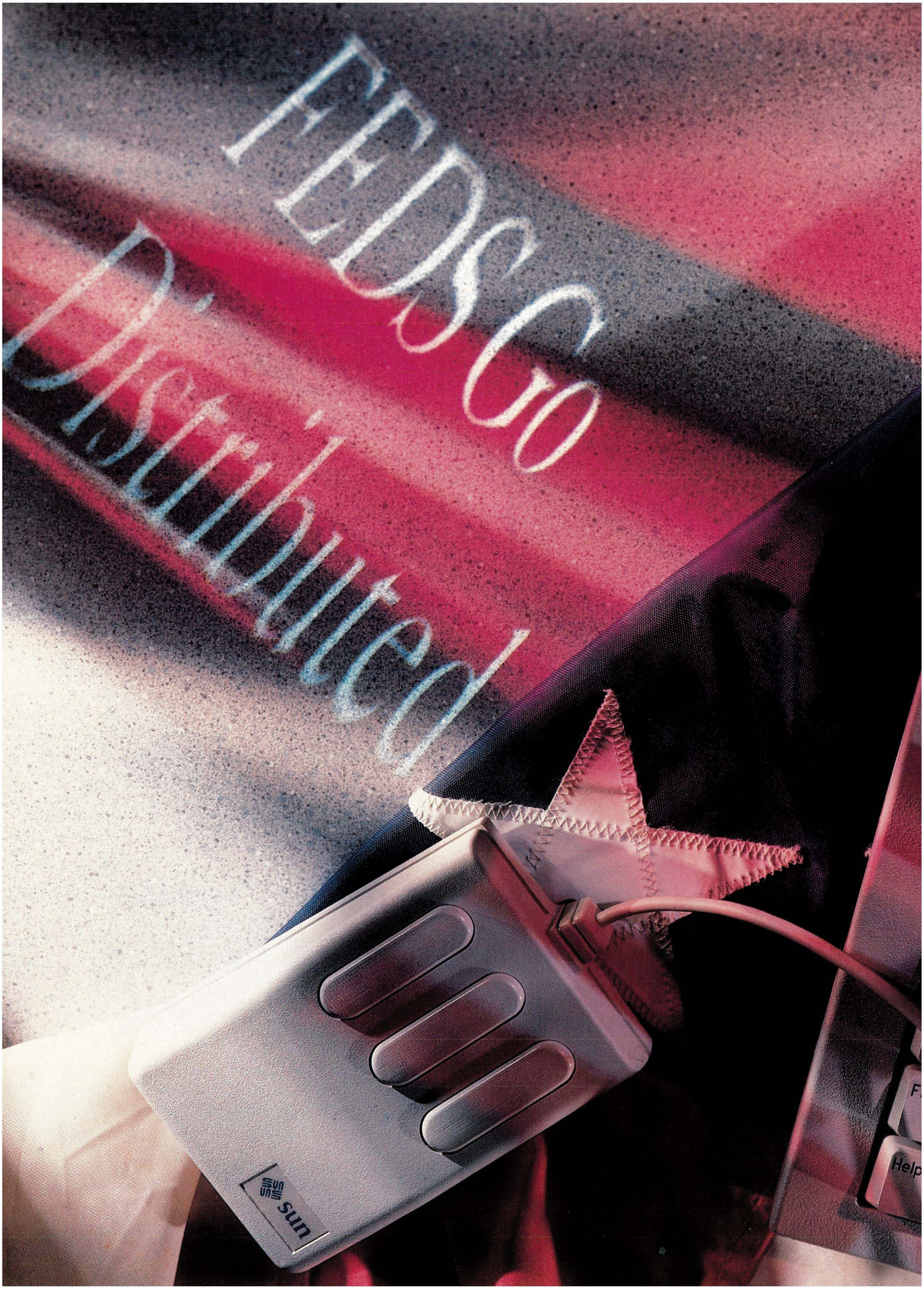
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now that 'networking' means more than 'Let's do lunch.'

There is a lot of stereotype-busting going on within the U.S. government these days–at least when it comes to technology.

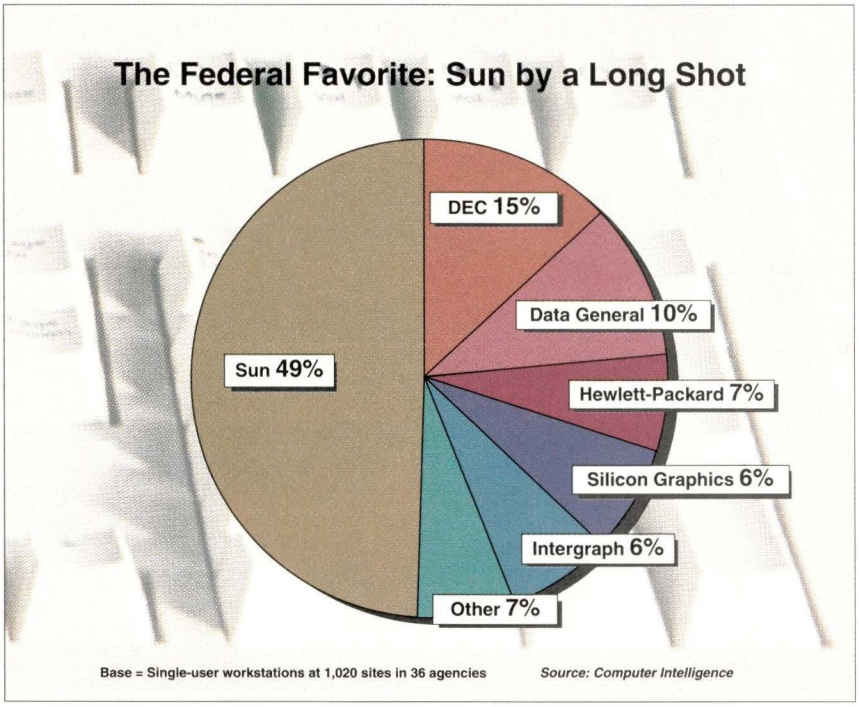
Equipment underutilization and overpurchasing won't disappear overnight. But there aren't many SPARCstations banging around the federal halls that are handling just word processing. SPARCstations are in high demand from all military and civilian segments of the U.S. government. (And in more than a few cases recently, they've been in short supply.) According to market researcher Computer Intelligence in La Jolla, CA, 49% of all of the workstations deployed in the government are Sun Microsystems Inc.-made. Agencies want and need the Sun systems' bit-mapped screens, power, performance and, of course, relatively low price. If they don't need them in large quantity, they are sure to need them at the very least for big applications: front-ending supercomputers, mega number-crunching, complex mapping and the like.

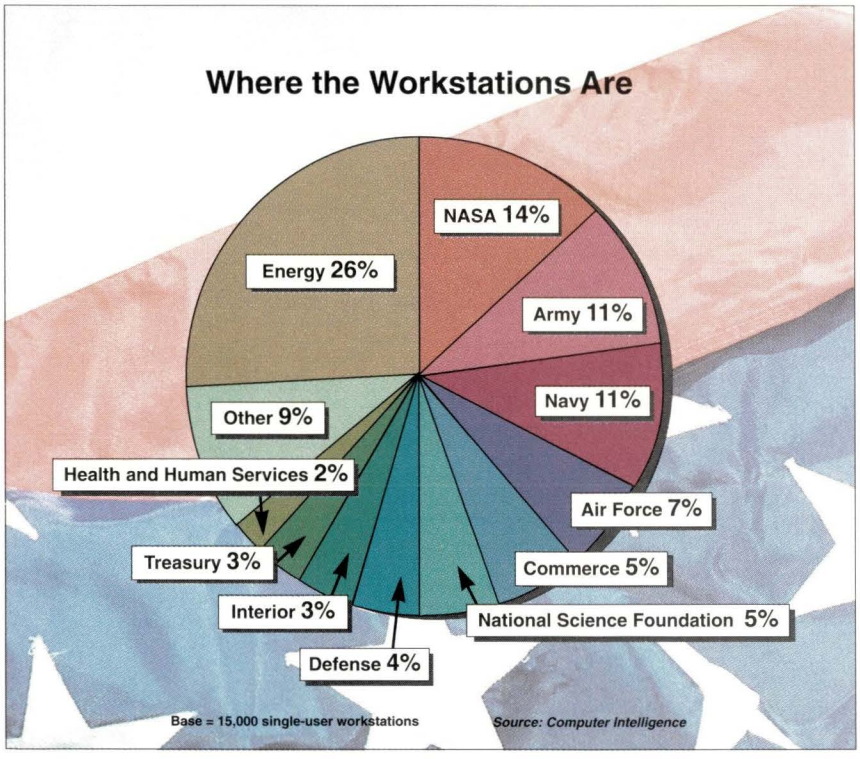
by MARY JO FOLEY, Senior Editor

LOGAN SEALE

There will always be bosses who think typewriters (or better yet, pencils) are the ultimate tools of automation. But there are individuals, departments and even whole federal agencies that are pushing the boundaries of workstation computing–especially in the area of distributed computing. Running apps *on the network*–not on the mainframe, or even just on the standalone workstation–is the norm for many government agencies today. That's more than most commercial shops can claim.

Finally, finding UNIX systems in the government is no longer like finding a Desert Storm critic in the Pentagon. (Do you know how many Sun systems were on the front lines and back rooms in Desert Storm? *A lot.*) All of the agencies have UNIX workstations and servers; some are just dabbling with them, while others are entrenched UNIX bigots. All of the armed services and intelligence agencies are big UNIX users. Other not-so-likely UNIX shops include the Departments of Energy, Commerce, Interior and Health and Human Services, according to Computer Intelligence. Most of the UNIX sites within the government tend to be fairly small, with 63% of all federal UNIX workgroups consisting of 100 users or fewer, says the Vienna, VA-based Information Strategies Group of International Data Corp.





To date, a major reason for the rise of UNIX within the government has been the increasing insistence within most federal requests for proposal (RFPs) for POSIX and GOSIP compliance. Few non-UNIX operating environments–with a couple of notable exceptions, such as Unisys Corp.'s CTOS–have supported either standard. But UNIX vendors won't be resting too much on their POSIX and GOSIP laurels in the future (at least if they want to grow their businesses), since suppliers are working toward providing POSIX and/or GOSIP compliance within almost every OS, from NT to OS/2 to VMS. (See "POSIX and GOSIP: The Emperor's New Clothes?")

Sun Fed: King of the Hill

As the hands-down federal workstation market leader, Sun is doing more than touting its POSIX and GOSIP strategies to maintain its position. Sun Microsystems Federal Inc., the 230-employee, Milpitas, CA-based subsidiary of SMI, has built quite a reputation for itself since its founding seven years ago.

In 1989, it launched its Sun Federal Third Party Offerings (S3PO) Program, under which state, local and federal agencies, as well as prime contractors and integrators, can buy directly from Sun Federal various third-party products developed by 20 or so designated companies. Among the products available from Sun Fed are the BriteLite SPARC laptop system (both commercial and TEMPEST ver-

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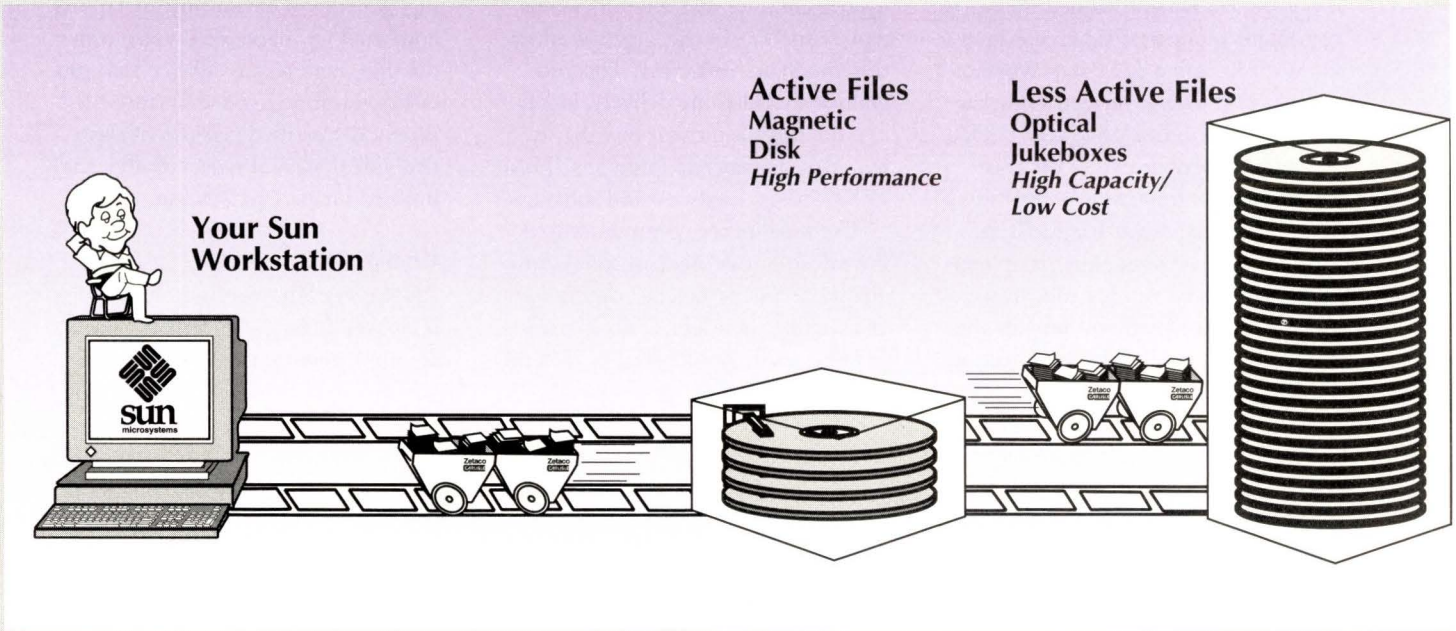

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sions) from RDI Computer Corp.; SBus expansion boxes, optical drives and jukeboxes from Artecon Inc.; and Lotus-1-2-3 from Lotus Development Corp. Just last year, Government Technology Services Inc. (GTSI) began offering Sun products on the General Services Administration (GSA) schedule. And next month, Sun Fed is slated to begin shipping the long-awaited SunOS CMW (Compartmentalized Workstation), a secure version of Solaris 1.0 (see "A Secure SunOS.").

Sun Federal's biggest coup occurred a few years ago when it landed the prime contractor spot on AFCAC 308–now known as Combat Air Force-Workstation, or CAF-WS–contract, valued at $50 million a year for five years. (This year marks number two of the contract.) At press time, Sun Federal was a finalist on three major-league RFPs: the Air Force Mission Support System (AFMSS), where Sun is a subcontractor to McDonnell Douglas to provide the Air Force with basic flight-line mission support systems; the Army's Sustaining Base Information System (SBIS), where Sun is teamed with Electronic Data Systems to provide replacement machines for the Army's base information systems; and the Defense Intelligence Agency's Services, Software and Support contract (DIA-SAS).

DIA-SAS is far from Sun Federal's first foray into the intelligence community. Compared with other UNIX vendors, Sun Federal receives a disproportionate share of its total business from intelligence contracts. Sun Federal is a subcontractor on one intelligence contract that, in Sun's words, represents "one of the largest workstation purchases in history. This program is an indefinite delivery, indefinite quantity, multiyear buy that is requiring commercial products, TEMPEST, special hardware and software."

"The intelligence community likes the price/performance, openness and quality of Sun products," claims Sun Fed's acting president, John Marselle. "They're really on the edge of technology and were among the earliest adopters of workstations." How many Suns are going into the National Security Agency, Defense Intelligence Agency, Pentagon, Central Intelligence Agency and other "black holes" is anyone's guess. Santa Clara, CA-based video-board vendor Parallax Graphics Inc., which sells quite a bit of its SBus-based product into the defense and intelligence agencies (in the vague way required by the intelligence bodies), lists among the applications being handled by Suns: geographic information system (GIS)/mapping, teleconferencing, generation of multimedia reports and briefings, networked video production, remote surveillance, computer-based training, video postproduction of declassified versions of classified videotape and radar, satellite and infrared imagery generation.

Ready, Set, Upsize

Not every Sun workstation or server is cloaked in so much secrecy. There are some departments within the

A Secure SunOS

Since 1991, Sun Federal Inc. has been talking about a secure version of SunOS that would adhere to B1 Orange Book and Compartmentalized Workstation (CMW) standards. Next month, Version 1.0 of SunOS CMW is slated to finally hit the streets.

What took Sun so long? SunOS CMW isn't just SunOS 4.1.1 (Solaris 1.0) with a couple of security features thrown in. To create the product, Sun Federal programmers needed change or modify a quarter of a million lines of SunOS' seven million to eight million lines of code, says George Sullivan, Secure Products Manager of Sun Fed. Besides, National Security Agency security checks take time, he points out.

The Solaris 2.0 version of the CMW product will require even more tweaking, and Sun Fed doesn't expect to ship it until mid- to late-1994, Sullivan says. Another CMW version, based on SunOS 4.1.2, was completed in July in order to meet some RFPs. Sun Fed doesn't plan to productize it, according to Sullivan. And a version supporting SPARCstation 10s running SunOS 4.1.3 is slated for completion early next year.

Secure SunOS means that root, or superuser, is divided into discrete parts, so that no single person has unlimited access to all systems, Sullivan explains. The result is that SunOS CMW "has two times the granularity of our competitors' [secure] operating systems," he claims. Other features that distinguish SunOS CMW from other secure operating systems, such as SVR4 ES (Extended Security), include secure networking and secure windowing, Sullivan says. "Others are meant to operate only in standalone mode," he says.

From a user standpoint, there will be little difference between Solaris 1.0 and SunOS CMW 1.0, Sullivan claims. Labels in different colors, indicating various levels of security, will run along the top of all screens. And at the bottom of all screens will be two stripes, enabling users to establish direct, trusted paths to the trusted kernel. Trusted versions of the Solaris electronic mail and file manager programs also will be integrated into CMW, Sullivan says.–*mjf*

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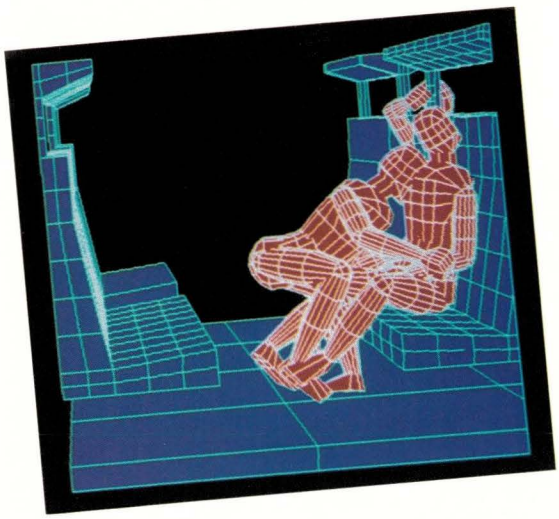
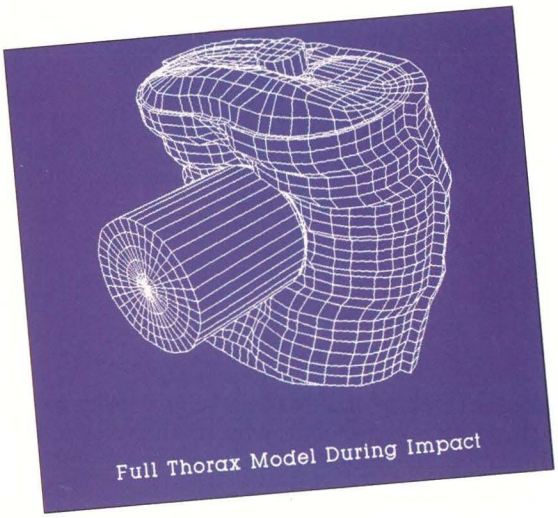


Commercial customers of the Lawrence Livermore National Laboratory's Message Development Group use the Group-developed finite-element analysis code to simulate real-world problems–like a subway accident or the impact of a car crash on a thorax.



armed forces that are employing Suns in unclassified–yet complex and fully distributed–applications. Take, for instance, the U.S. Navy's Naval Oceanography Command. The Command's Stennis Space Center, MO-based Naval Oceanographic Office is performing data analysis and "now-casting" with a Sun/Cray Research Inc. server-supercomputer combination.

The office is chartered to track information about all of the world's oceans. This information helps the Navy improve fleet positioning by analyzing ocean and atmospheric currents, water depth, temperature, salinity, etc. (The center also ships this information to other agencies and organizations that are interested in oceanographic data.) The data is collected by ships and satellites throughout the world. The Stennis site is primarily an R&D operation, while its sister site, the Fleet Numerical Oceanographic Center in Monterey, CA, is a full production site. The two offices are linked via a T-1 line.

At the Missouri center, there is a classified and an unclassified side to the network. The unclassified side runs a Cray Y-MP8 and Y-MP2E. The 2E operates as a back-end file-processing system, supporting Storage Technology Corp. Model 4400 silos housing 2.5 terabytes of data. The front ends to the Crays are two Sun-4/490s. The Suns and Crays are connected over UltraNet; the Suns access the storage silos via NFS. On the classified side, there is a Cray X-MP with a Sun-4/390 front end and Storage Technology silos.

The supercomputer center is running the latest and greatest version (6.0) of the Empress Software Inc. Empress database management system on all of its platforms. The majority of data stored will be in binary large object (BLOB) format. Why Empress? Computer systems specialist for the supercomputer center, Terry Blanchard, explains that "Empress runs on Crays and Suns and can store images and gridded data, not just point-to-point data." This wasn't true of other databases evaluated, he says.

The center is in the midst of migrating its Unisys mainframe-based data to its Cray/Sun network. Data currently stored as FORTRAN code will be moved into Empress. This migration is occurring under the auspices of the $250 million Primary Oceanographic Prediction System (POPS), which is being handled by prime contractor Grumman Data Systems. Grumman is providing the hardware, software, installation, operation, maintenance and support services for POPS. Besides integrating the supercomputer center and Fleet Numerical, as part of POPS, Grumman is automating the overarching Naval Oceanography Command, whose 900 to 1,000 employess currently employ 80 Intergraph Corp., 20 Silicon Graphics Inc. and 30 to 40 Sun desktops and servers.

A similar Cray/Sun combination is in place at the Message Development Group, Engineering Directorate, within the Lawrence Livermore National Laboratory (LLNL). LLNL does a lot of R&D for the Department of Energy, among other agencies. Although its original intent was to develop finite-element analysis code needed by other groups within LLNL, the development group has written code that has found its way into use in places as far-flung as McDonnell Douglas, Coors Brewing Co. and Frazer-Nash Consultancy for stress-analysis simulation and modeling. In Coors' case, the code helps engineers determine the amount of pressure beer cans can sustain before denting. Frazer-Nash, a U.K.-based mechanical engineering firm, employs the code to simulate passenger-train accidents in its work for the Health and Safety Executive, a British government agency.

The code-development group includes 10 software developers and 10 to 15 engineering analysts. These individuals have access to 20 to 30 diskless Sun clients (mostly SPARCstation 2s, with some SPARCstation 1s and Sun-4/310s), which are networked to an Auspex Systems Inc. NS-5000 file server and a few Cray supercomputers (a Y-MP8, X-MP4 and X-MP48).

The developers write code on the Suns, primarily using SunPro's FORTRAN SPARCompiler and various development-group-devised tools. (The group does a limited amount of

graphics-related programming in C.) The analysts use the Suns either as front ends to the Crays or as stand-alone systems to analyze and visualize (using in-house-developed algorithms) how various structures respond to static and dynamic loads. The results of their analyses are output into large, binary databases which are, in turn, run on the Crays or Suns (depending on the complexity and size of the data).

Among the various pieces of code developed by the group are Dyna (for time-dependent problems), Nike (for static problem analysis), Ingrid (for analysis preprocessing) and Taurus (for postprocessing).

Getting Down and Dirty

Not everyone needs a Cray. Downsizing is just as prominent, if not more so, than upsizing within the Beltway. The Library of Congress' Information Technology (IT) Services department, for one, is moving part of its document imaging application from SPARCstations to PC clones.

The Congressional Research Service (CRS) of the Library of Congress provides senators and representatives with up-to-date information in more than 300 subject areas. To make journals, government reports and other printed materials and articles more accessible to the CRS, the Library awarded IA Corp. (formerly Litton Automated Integration) a contract to install a document-imaging system based on a Sun server and employing multiple SPARCstation access stations.

IA/Litton installed a precursor to the current system–a pilot jukebox–in the Library eight years ago. The document-imaging system is currently a full production system, which is being expanded upon by IT services.

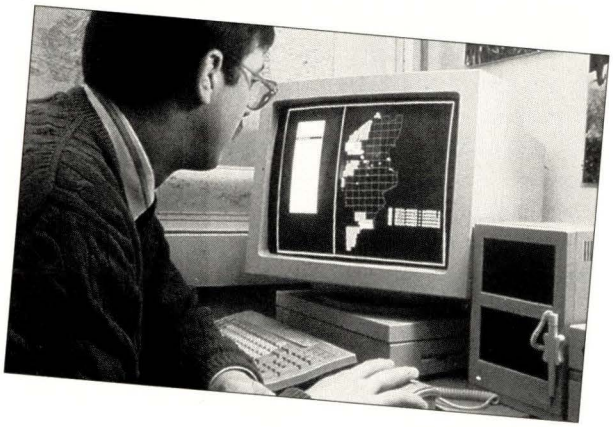
The system is configured as follows: On the Ethernet backbone resides a Sun-4/70 server, two jukeboxes (a Hitachi Data Systems Corp. OD301A1 and a Signet 1802 with Hitachi drives) and two scanners (a Terminal Data Corp. floor model DS4140I, complete with a Litton camera, and a Fujitsu Computer Products of America desktop M3093E for backup). CRS can scan 2,500 pages into the system daily and store articles on the optical jukeboxes. The system is managed by IA/Litton's DocuVision software, which was developed jointly by IA and the Library.

A handful of SPARCstation 1s, 1+s and IPCs are used by IT for quality review and for monitoring the server. Several more are scattered throughout the Library and are designed to be reference stations for CRS members. (One SPARCstation is even located in the offices of the Joint Committee on Taxation.) The SPARCstations are linked to the server via two Cisco Systems Inc. AGS+ routers over an FDDI link.

Also linked to the backbone–this time via an OpenConnect Systems Inc. (formerly known as Mitek) M2030-64 server–is the Library's mainframe, where bibliographic information is stored. This mainframe is the heart of the Library's 20-year-old subject retrieval/indexing system, called Scorpio. Scorpio keeps track of all of the materials scanned into the document-imaging system by ID number. The document imaging system's 1,000 subscribers (700 senators and reps and 300 congressional researchers) receive bibliographic information on areas of interest they select from printouts generated by IT. Upon receipt of their subscribers' requests for information, the CRS staff can call up and print the requested information–which currently numbers 10,000 article pages daily.

The Library is in the process of downsizing even further. It is moving the DocuVision application to 80486-based PC clones. (Its first shipment will be from Zeos International Ltd.) Ultimately, it plans to move the application to 386 systems, so that it can put one PC in every CRS subject office–and ultimately one in every Senate and House office.

Not all SPARCstations need to be girded for battle–such as the Codar Technology Corp. system above. Some handle more genteel applications such as complex mapping of flora and fauna, as performed by the U.S. Fish & Wildlife Service's Realty Division.



But L'Enfant didn't design D.C. in a day. And downsizing/rightsizing/smartsizing doesn't (and shouldn't) happen in one fell swoop. The Anchorage, AK-based U.S. Fish & Wildlife Service (F&WS) Division of Realty has been making the move from minicomputer to SPARCserver for a few years, says Jean Wylie, a F&WS programmer analyst.

The Realty Division is charged with establishing priorities on the parcels of Alaskan land destined to be acquired

by parties who can ensure the welfare of the plants and animals living on them. To do this, F&WS needs data more detailed than the existing federal Bureau of Land Management maps provide. F&WS needs to cross-reference descriptions of waterfowl, moose, muskox or fish populations with ownership data to give biologists a color-coded summary of areas of concern.

Two years ago, F&WS stored all its information on a Data General Corp. MV8 minicomputer. Now, F&WS uses a SPARCserver 470 to maintain land status, parcel, ownership, case, land claim information and the like. This data comes from a variety of sources (including the Bureau of Land Management) in ASCII format. Six to eight SPARCstation 2s are used to collect mapping data and attributes; three

POSIX and GOSIP: The Emperor's New Clothes?

by Willie Schatz

There's only a tiny item missing from federal government agencies' campaign to make GOSIP and POSIX the truth, the light and the way: Users.

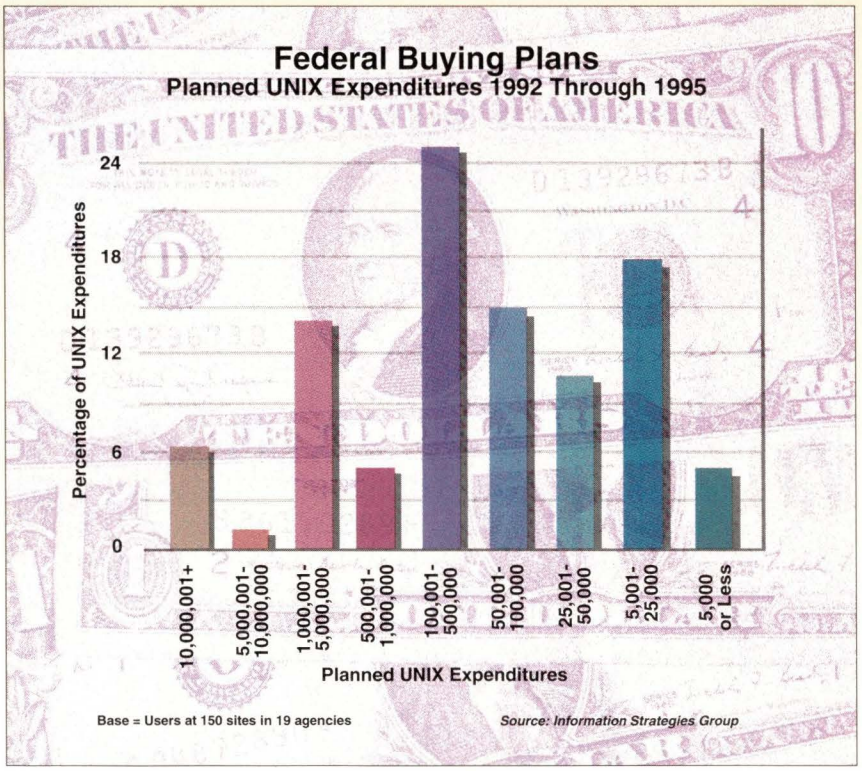
"All our major procurements require GOSIP and POSIX migration plans and conformance plans," says Steve Broadbent, the Treasury Department's deputy assistant secretary for information systems. "And there are a lot of good GOSIP products and POSIX products in the market. But users are continuing to buy proprietary standards. There's a large support base for proprietary products such as LANs from Novell [Inc.] and other major providers. Those aren't GOSIP compliant, but users have a lot of experience with them. It gives them a lot of comfort."

Even Sun Microsystems Inc. admits that while the requirements are plain, acceptance is mixed. Especially within the Department of Defense, mandatory POSIX and GOSIP compliance is written into requests for proposals (RFPs), says John Marselle, acting president of Sun Federal Inc. "With respect to the non-DOD side (civilian agencies and departments)," he says, "it is a mixed bag. POSIX appears regularly as a requirement; GOSIP does not." The bottom line, according to Marselle: "Even though the message is clear, actual implementation requirements are somewhat flexible."

Painful though it may be, the Treasury and other agencies reflect this reality as they struggle to drag their computing systems into the 20th century. Agencies are legally required to use GOSIP products, so the requisite language is everywhere in their RFPs. But both sides know the real story.

In its $350 million, 10-year Treasury Communications Systems (TCS) RFP, for example, the agency cuts the contractor plenty of slack. "The TCS shall provide an interim Directory Service application based on the international standards ISO 9594/CCITT X.500," the RFP says. "Treasury recognizes that Directory Service requirements are beyond the present version of GOSIP. The Government Open Systems Interconnection Profile will evolve over time to include additional protocols and services. The TCS contractor shall offer new mandatory GOSIP services and/or products within 18 months of the publication date of the revised Federal Information Processing Standard."

Don't hold your breath for that one. Although agencies must use GOSIP products for their interagency communications, GOSIP won't become compulsory for intra-agency communications until fiscal year '94 (which starts October 1, 1993). That roost is currently

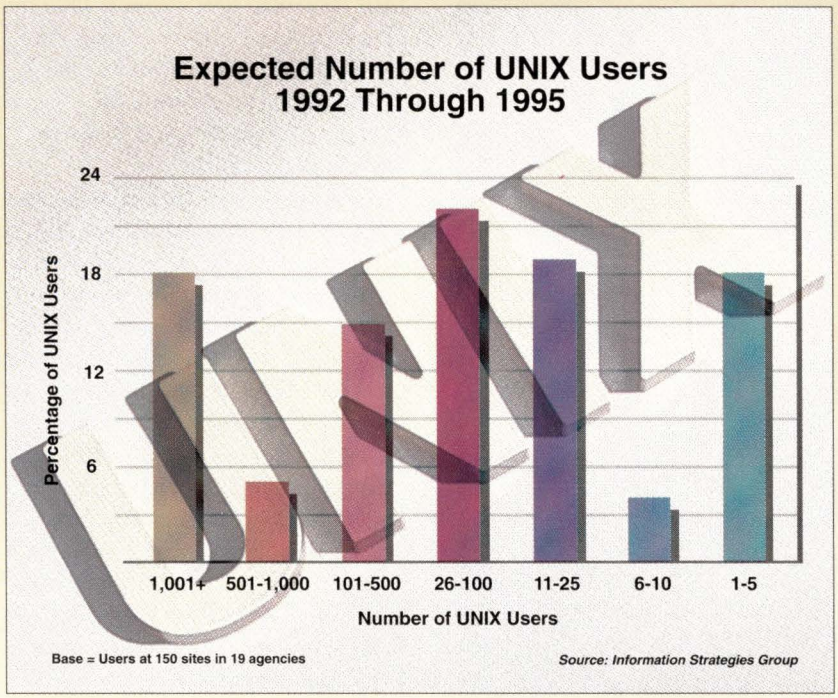


386 PCs digitize land-parcel data. A Calcomp electrostatic plotter (Model 68444) and Tektronix Inc. Phaser III printer are used to provide paper-based reports and other hard copy.

Networking is handled via Ethernet/ThinNet using NFS and PC-NFS. Within the next six months, however, Wylie says, F&WS plans to rewire and run a fiber-optic network between Chipcom Corp. converters, with 10-Base T connections made to individual workstations.

F&WS runs Arc/Info GIS software from Environmental Systems Research Institute Inc. (ESRI) across its network. The Alaska Priority System described above was written using Arc/Info macros. PC Arc/Info runs on the 386s.

"Before we had this system, we didn't



ruled by TCP/IP. And according to Frank Dzubeck, president of Communications Network Architects, a Washington-based consulting firm, GOSIP is not about to pull off a coup. And although POSIX products are further down the acceptance road, they're not going to be on every desktop any time soon either.

"When they made the edict that all procurements must be GOSIP compliant, it was a little bit aggressive," Dzubeck contends. "The standards were not to the state they should have been. So the level of [GOSIP] penetration is more lip service than reality.

"You don't see any serious GOSIP propagation because there are no healthy applications. And you're not going to see things really start to increase in government use until you start to have more applications associated with GOSIP. It's like a Catch-22 syndrome. There's plenty of GOSIP versions, but the specs aren't detailed. So users stay with TCP/IP because it's more readily available and implementable. There's more interest in GOSIP, but it's no groundswell. But it's starting to shake loose."

When it does, Dzubeck forecasts that UNIX operating systems, now the overwhelming favorite among government users, will fall off the face of the earth. He says Microsoft Corp.'s Windows NT and IBM Corp.'s OS/2–probably, but not necessarily in that order–will wipe out UNIX. And Sun, if it plays its hand smartly, could maneuver Solaris into third place.

"UNIX still has the stigma of an elite operating system," Dzubeck says. "Right now users are UNIX-biased. But they won't be in the future when Windows NT and OS/2 become POSIX-compliant. Then there will be open warfare, and the government will have many different operating systems to choose from." Then GOSIP-compliant and POSIX-compliant products might be where their proponents expected them to be already.

"All the agencies want GOSIP-compliant and POSIX-compliant products," Treasury's Broadbent says. "But you've got to balance your need to continue to modernize versus the marketplace reality. You'd be limiting competition if you required full compliance today. There'd be only one or two bids instead of four or five. The taxpayer would pay a premium for that that's just not worth it. We're very serious about moving to open systems and adhering to standards, which both GOSIP and POSIX will accomplish. I think we're making very good progress in that direction. But we can't go any faster until there's sufficient pressure from the public sector and the private sector to do that."

Willie Schatz is a Washington, D.C.-based free-lance writer.

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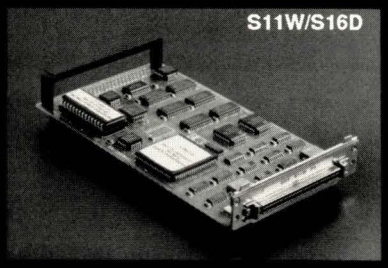

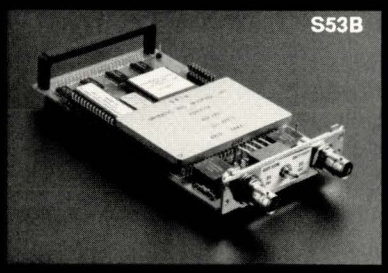

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even try to keep track of this kind of data," says Wylie. Now, every other fish and wildlife office is still doing this [kind of cross-referencing] by hand because they're smaller than us. But there's lots of interest in making land status information available."

D.C. = Distributed Computing

Whether they're upsizing or downsizing, nearly all of the federal Sun sites seem to be most interested in maintaining fully distributed data across their networks. This is true at all of the aforementioned agencies. Yet another case in point is the Federal Reserve Board's Research and Statistics Division, Automation and Research Computing Section.

The Section currently is running two Amdahl Corp. mainframes (consolidated recently from three) and plans to be running only one mega Model 5890-6000 mainframe by next year. It is phasing out all of its Sun-3 equipment (4/3XX machines) and relying instead on "tons" of SPARCstation 2s, 1s, 1+s and IPCs, says Louise Roberts, senior information systems analyst for the Section and for Monetary Affairs. The SPARCstation 2s are working as both servers and desktops. The section is also running 12 IBM Corp. PC/ATs (used almost exclusively for file transfer), 250 X terminals (just upgraded from dumb terminals) six Solbourne Computer Inc. 500 series servers and 40 laser printers (almost all Hewlett-Packard Co. LaserJet IIIsi's, with a couple of Sun SPARCprinters thrown in). The section just took delivery of two SPARCserver 670MPs and plans to upgrade them with SuperSPARCs A.S.A.P., Roberts says.

The section is networked using Ethernet/TCP/IP in a bridged environment, using primarily IB/2 bridges from 3Com Corp. (Interestingly, the rest of the Federal Reserve Board runs on token ring.) Due to a recently completed RFP, the Section is in the process of replacing its bridges with routers, according to Roberts.

"The domestic research division uses the net for everything from word processing, to database management, to statistical analysis," she explains. It employs the net for large-scale simulations, requiring heavy number crunching, bit-mapped screens on every desk and real-time data monitoring. The Section creates statistical releases that go to the public and reports that go to the senior staff and Board of Governors.

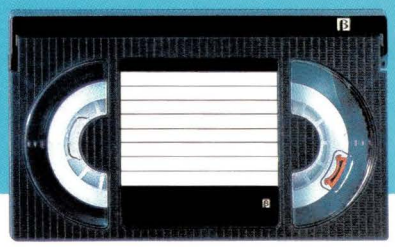
The mainframes are connected via SunLink to the Sun servers, which are connected over Ethernet to the various desktops. The Section runs the Citicorp FAME database, a nonrelational DBMS that is geared toward the management of time-oriented data (and can convert weekly data to daily or monthly data and vice versa). Data is entered into FAME from a huge variety of sources inside and outside the fed in a multitude of formats (tape, electronic transfer–"everything from PC diskettes to 9-track tapes"). All in all, the system contains 250 GB of storage, mostly SCSI.

Automation and Research Computing runs Speakeasy Computing Corp.'s Speakeasy statistical software and employs the Speakeasy economic modeling language to write applications, Roberts says. Other applications that the Section distributes across its network are the complete SAS system from SAS Institute Inc. and the WordMARC word-processing package from WordMARC International Corp.

SPARC Affords Scalability

Because the federal government isn't a monolith, it's hard to make generalizations. There's lots of downsizing–and upsizing–going on out there. More and more customers are pioneering the distributed model of client/server computing; but for some government applications, batch processing works very well. "Most of our leading-edge customers are moving further and further away from mainframes," claims Sun Federal's Marselle. "The first step toward this is ususally offloading an application by front-ending a mainframe with Suns." In the end, however, all government users want scalability, Marselle says. "They want to move their applications to a more effective, common hardware suite." And here, Sun, with SPARC, is positioned well. ⊸

What can Sun users learn from the battle between VHS and Betamax?



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"What are people using them all for? Why are they buying so many?"

–Attributed to an IBM vice president at a time when the IBM PC was selling only a few thousand per month

PC-NFS

by IAN DARWIN, for Computer Publishing Labs

SunSelect's PC-NFS tutors IBM PC clones in standard networking lingo to bring them onto the corporate network.

The quote above may be apocryphal, but IBM-style personal computers have certainly been used for just about every type of computing task. One problem with using IBM PCs and compatibles in a corporate environment is that the PC, unlike most UNIX workstations, was never designed to include standard networking hardware or software. As a result, there are a variety of incompatible networking technologies in use. In a PC-only environment, it may be acceptable to select one of these networks. But in an environment that includes a significant number of UNIX servers and workstations, it is probably better to teach the PC clones to talk TCP/IP and NFS so they can communicate and share data with the other NFS-compatible machines in the network. SunSelect's PC-NFS product does just that.

The Pieces

There are several members of the PC-NFS product family. The base package consists of PC-NFS itself, the software that enables an MS-DOS-based PC to become an NFS client, an LPR printer client or even an LPR server. Optional parts include Lifeline (mail and backups for those adrift on a PC), and a developer's kit that lets programmers build Socket-, TLI- and RPC-based applications under DOS.

We tested the software in two environments and found no major difficulties with it in either. System 1 is an XT-class machine (10-MHz 8088, 8-bit 3Com Corp. 3C501 network

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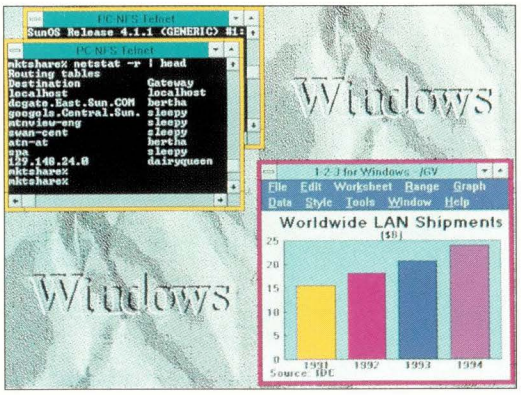
board) running Digital Research Inc. DR DOS 6.0 on a network with only a SPARCstation and an Imagen networked printer, from Imagen Corp., now a subsidiary of QMS Inc. System 2 is a network with a variety of generic 386s (80386-25DX, some 3C501s and some 16-bit Western Digital Corp. Ethernet boards) running MS-DOS 3.3 or 5.0. The system shares a network with about 20 other systems of all makes and models: servers, workstations, X terminals and laser printers. Both networks use thin Ethernet coaxial cable; this software uses TCP/IP, UDP/IP and RPC, so it should perform without change on any operational Ethernet network. In particular, it mounts files from an IBM Corp. RISC System/6000, several SunOS servers and one or two others.

Speaking of configurations, Version 4 of PC-NFS supports a variety of Ethernet adapters (3Com, Ungermann-Bass Inc., Racal-Interlan, Western Digital). PC-NFS also supports token ring using either the IBM PC AT/XT or PS/2 adapter, or any adapter (either Ethernet or token ring) that has an "NDIS" driver (an industry-standard network device driver interface; more on this later). It also allows for a board manufacturer to provide a PC-NFS driver, though I don't know of any who do so at present.

If you have no network board or are far away from the local network, PC-NFS also supports SLIP, the Serial Line Internet Protocol that is standard or available on 4BSD, SCO, Interactive and most modern versions of UNIX. A complete SLIP driver package is included with PC-NFS, so you or your system administrator can install SLIP in your SunOS kernel (the code provided requires a STREAMS-based kernel, so would be difficult to install on older UNIXes). If you want to use NFS to access files over SLIP, you *must* have an error-correcting modem or local dedicated line. This is because the normal NFS protocol uses a network layer called "UDP," which does no error checking of its own, having been developed for use on local networks in which the hardware does error checking. You can use the utilities (`rcp`, `rsh`, `telnet`, `ftp`) over SLIP on a non-error-correcting modem, since TCP does its own error checking.

The basic PC-NFS package includes all the software needed to enable a PC with any of those network drivers to access files from a UNIX machine. It also includes `telnet`, `ftp`, `rsh/rlogin` and `lpr` client programs, as well as several standard (for Sun Microsystems Inc., at least) information clients like `rup`, `rpcinfo`, `lpq` (really `lpt q`), as well as `niscat` (`ypcat`), `nismatch` (`ypmatch`) and others. A complete list of commands is in Tables 2 and 3. Your Sun UNIX system has all the parts needed to make files available to PC-NFS clients (though if you're still running SunOS 4.1.x, be sure you have the "options NFSSERVER" in your configuration file to include the NFS server-side code in your system, and have built a kernel with it).

There is one little irony, however. A program called `pcnfsd`, while not strictly part of PC-NFS, is required on at least one UNIX system on the network. It is an "authentication server." Not to be too uncharitable, but MS-DOS simply has no notion of users as individuals: Anyone who has access to the console of a running PC normally has unrestricted access to all files on the PC. This is equivalent to "superuser access" under UNIX and is obviously not suitable for use on networks, so every PC networking technology has to invent its own notions for representing and validating users. PC-NFS,



PC-NFS 4.0 provides full Microsoft Corp. Windows 3.1 support.

SunSelect's PC-NFS includes the core product, PC-NFS LifeLine Mail and Backup, Advanced Telnet and the PC-NFS Programmer's Toolkit.

Table 1. The UNIX-to-DOS Name Game

UNIX Name	DOS Name	Description
main.c	MAIN.C	A simple C program source code
main	MAIN	UNIX executable; can't run on DOS
main.exe	MAIN.EXE	DOS executable; can't run on UNIX
.cshrc	~CSHR~XA	Original name invalid (no filename)
chap.1.t	CHAP~~FQ.1	Original name invalid (too many dots)

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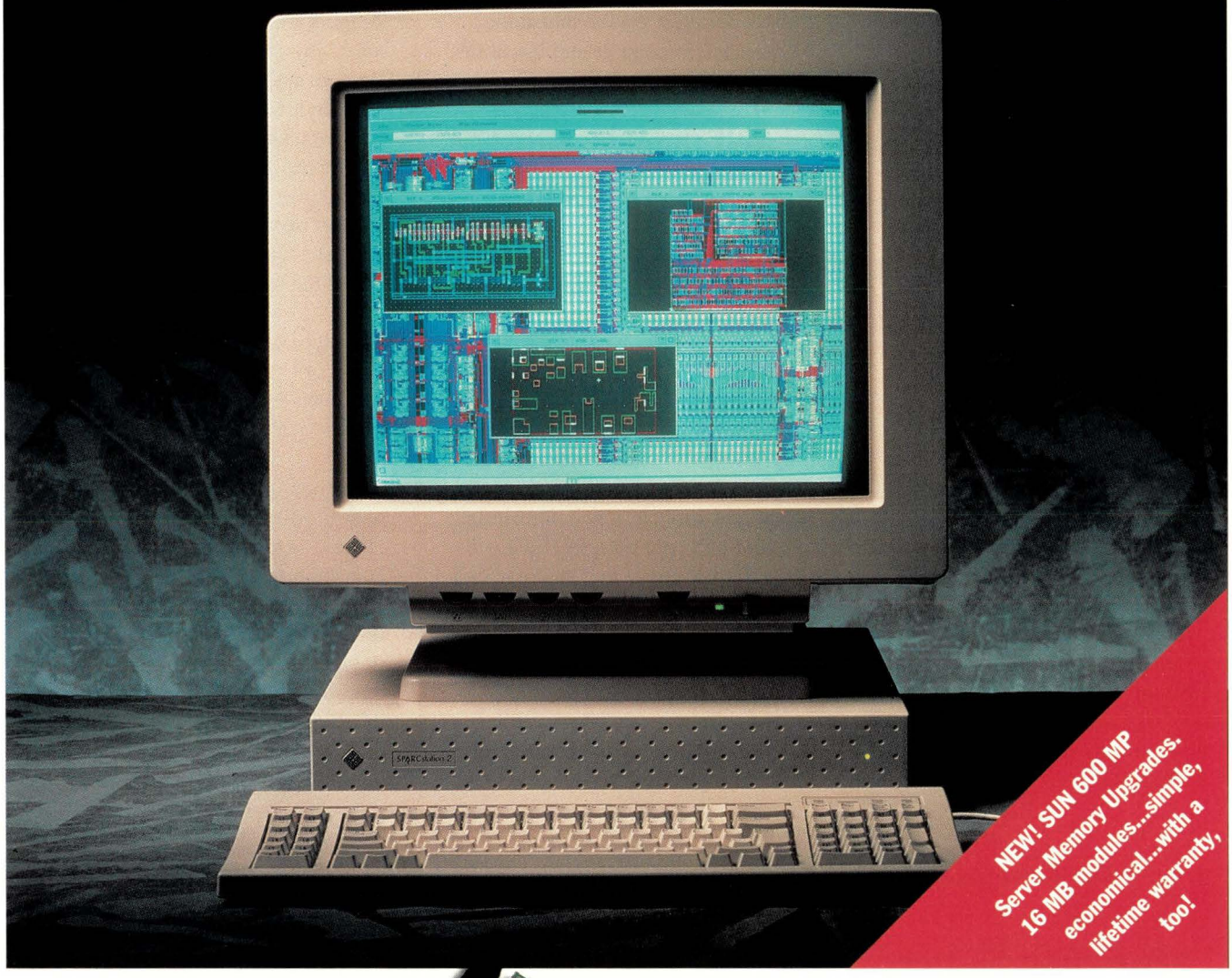

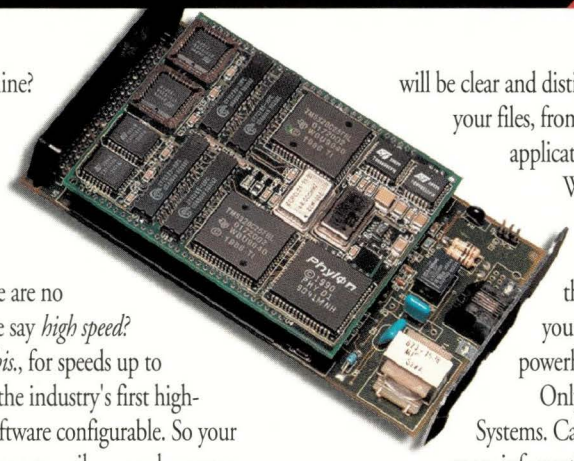

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being derived in the UNIX pattern, naturally and wisely chose to adapt UNIX conventions. Thus a PC-NFS user can give a login name and password, which PC-NFS verifies against the password file or YP–for Yellow Pages, now known as Network Information Service, or NIS–map; if they match, users have full access to their files as they would if logged in at a workstation. But what about DOS users who don't yet have a UNIX account? Simple; they run as user "nobody," the same ID used to restrict "root" access on UNIX workstations from spreading across the network.

Where's the irony? Well, just about every vendor of UNIX systems, even IBM, includes `pcnfsd` already compiled and running on their systems, with one exception. Guess who? Give yourself a chocolate munchie if you guessed Sun, because that's the right answer. Sun alone forces you to compile and install the authentication server from sources included with PC-NFS. Just follow the simple directions, and you're on your way. The irony is, if you don't install `pcnfsd` on your Sun, PC-NFS will search for a server, and you may find yourself with an OSF vendor's system being the NFS authentication server for your IBM PC.

Actually, Sun's distribution of `pcnfsd` in this way does have one advantage: You get the latest version (`pcnfsd` protocol Version 2, which has a few additional features, including the ability to create virtual printers); all the other vendors still ship `pcnfsd` Version 1. The virtual printers are well-thought-out; you can apply any shell command to filter or validate data from the PC before sending it to the actual printer, but an `lpq` command will list all jobs queued for the real printer, not just for the virtual printer. For example, to get WordPerfect to print on my Imagen in Diablo emulation mode, I just added the following single line to `/etc/pcnfsd.conf`:

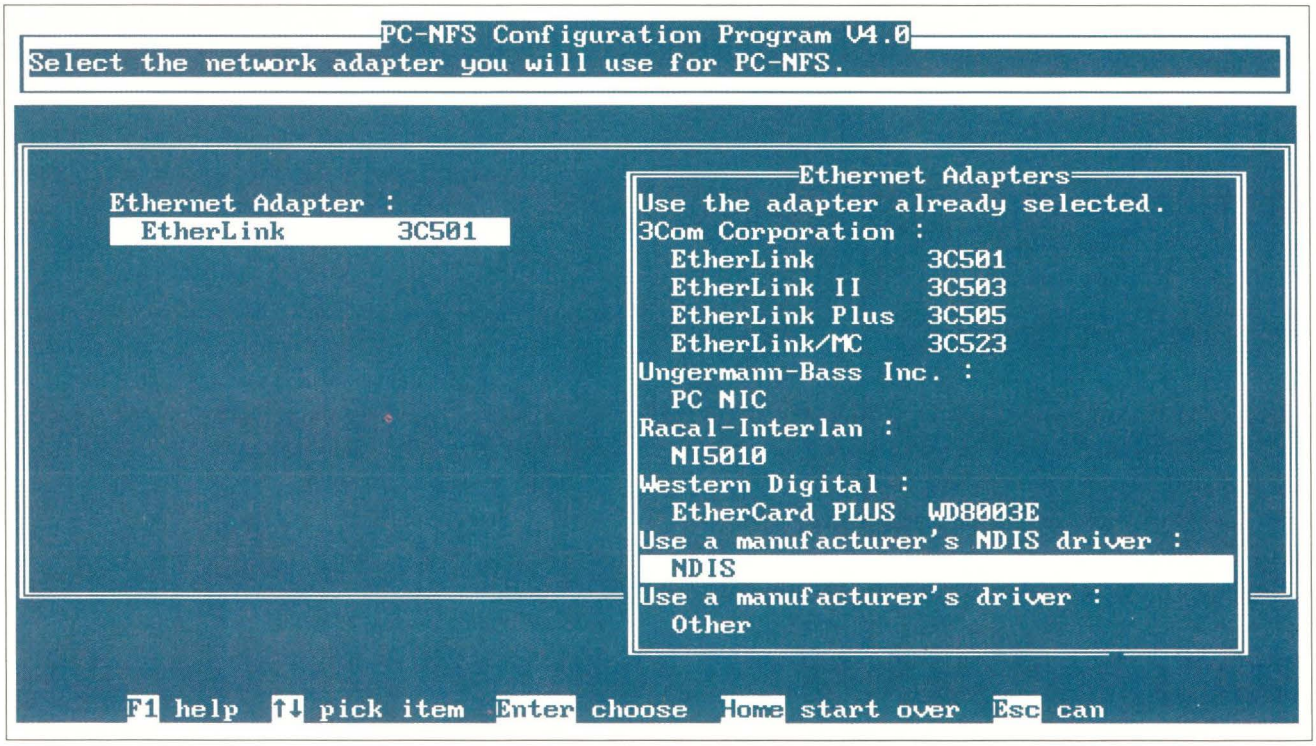
```
printer daisy imagen ipr -Ldaisy $FILE
```

The word "printer" is a keyword; several other parameters can be set. "Daisy" is my name; "imagen" is the existing printcap file. The command `ipr -Ldaisy` tells PC-NFS to use the Imagen `ipr` command to print the file, with the Language Daisy option, on whatever *file* you are printing. It's actually easier to use than to describe.

And it works.

The virtual printers are well-thought-out; you can apply any shell command to filter or validate data from the PC before sending it to the actual printer.

In this section of the installation, you tell PC-NFS which networking board is installed on the PC you are using.



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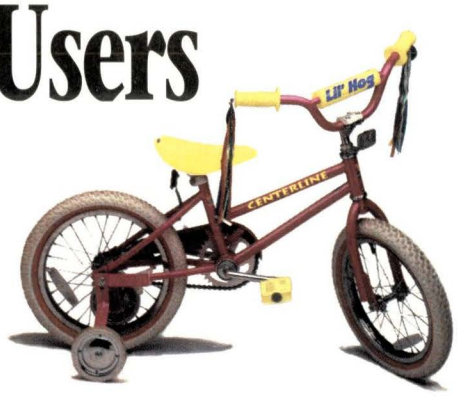

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Installation

And speaking of installation, installing PC-NFS itself is a breeze. SunSelect gives you a full-screen menu package that has you configured and installed just about as fast as your sloppy disks can spin the data in. (If you're short of disk space locally, you can even install most of the applications on a server and have a minimal set on your PC's hard disk. It's documented.)

Or, if your PC has only low-density floppies, you can copy from the two high-density distribution floppies to seven low-density ones just by saying

```
A> install -h2l b:
```

assuming that you have access to another PC where "A:" is the high-density drive and "B:" is a drive that can write low-density floppies. When you buy PC-NFS, you get both 3½- and 5¼-inch high-density floppies.

Like most PC installations, this one (optionally) updates your CONFIG.SYS and your AUTOEXEC.BAT files. CONFIG.SYS is modified to install a couple of device drivers needed for PC-NFS, while AUTOEXEC.BAT gets tweaked to start two programs: the "print redirector" that catches files destined for remote printers and sends them to the remote UNIX printer, and "net init," which actually starts up PC-NFS and mounts any directories and printers that you told the install program to mount on each reboot. In short, the install process is simple and works well.

The only criticism of the install process–as of PC-NFS itself–is that it's a bit short on detail when things go wrong. For example, when it runs out of space, it dies without telling you how much more space would have been needed. When a mount (or "net use") fails, you sometimes get a message like

```
The Net Use failed, Code 5
```

The installation is reasonably robust, though. Putting the wrong floppy in doesn't cause any grief, as with some older PC install programs. It simply keeps asking until you install the desired floppy. But, if you do encounter problems, SunSelect has an 800 support number for PC-NFS. If you are a licensed user, you can call (800) USA-4SUN. Be ready to recite your PC-NFS serial number.

Table 2. List of Commands

arp	Address Resolution Protocol
chmod	Change mode of NFS file
connect	Connect to a modem
dos2unix	Convert text file from DOS to UNIX file format
unix2dos	Convert text file from UNIX to DOS file format
finger	Display information about user(s) on UNIX
ftp	File Transfer Program
hangup	Disconnect PC-NFS from modem
install	Install or upgrade PC-NFS
listener	Start TSR to listen for send messages
lpt a	Administer local printer
lpt d	Remove job from print queue
lpt q	Display print queue
ls	List files, like UNIX ls
mv	Rename files, like UNIX mv
myeaddr	Find address of your Ethernet board
net	Network control program; see Table 3
nfsconf	Set up or change PC-NFS configuration n
fsping	See if a host runs NFS
nfsstat	Show NFS statistics
niscat	Display values from NIS database (ypcat)
nismatch	Match given key in NIS database (ypmatch)
pcnfslpd	PC-NFS line printer server program
ping	Test IP connectivity with given host
rcp	Remote copy file(s)
rdate	Copy server's date and time to client
rnmfile, rnmnis	Load Resident Name Server (TLI)
rpcinfo	Display RPC info from host
rsh	Remote shell
rtm	Load resident transport
send	Send an RCX message
showmnt	Show mounted or exported directories (showmount)
snmp	Load the SNMP agent
telnet	Start a telnet session

Licensing

And speaking of serial numbers, PC-NFS licensing is nonintrusive; you don't have to do anything special. Each floppy copy is serialized at the factory, and only one copy with that serial number will run on your network. The normal user doesn't have to muck about with license files or anything complicated; the software does the work. This is as it should be.

The Commands

The "net" program in PC-NFS, as in some other PC network program, has a bunch of options. These are listed in Table 3.

I mentioned the existence of `telnet`, `ftp`, `rsh/rlogin` and `lpr` client programs, and `rup`, `rpcinfo`, `lpq` and other info clients. These all behaved

perfectly well, as near as I could see. The "session-based" ones–`telnet`, `rlogin` and `ftp`–are also shipped with Program Information Files (PIFs) so that they can be used as full-screen applications under Microsoft Corp. Windows. This works, but with the limitation that you can only run them in full-screen mode; for example, you can't have an ftp running in one window while editing a file in another. This has been fixed in the current version, 4.0 and 4.0a.

The basic package also lets your PC use remote printers *and* make its printer available to the UNIX network. You can mount any remote printer on top of DOS's LPT1, LPT2 or LPT3. Most DOS applications work to these printers. However, we had some problems mounting these printers; we kept getting the message "The specified filesystem is not local to server system1." These were due to our failure to read the fine manual–we'd forgotten to export `/var/spool` on the server after an OS upgrade–and printing now works just fine.

Equally interesting in some environments is use of the PC's printer as a UNIX slave printer, so you can `lpr` from UNIX and have the output appear on the PC's printers.

We plugged an old Epson MX-80 into the PC in Network #1 and started up `pcnfslpd` on it:

```
pcnfslpd -P LPT1 mx80 -l -x
```

Then we put an entry in /etc/printcap like this:

```
epson|mx|mx80|Epson MX-80 on
darby via PC-NFS:\
  : lp=: rm=darby : rp=LPT1:\
  : sd=/var/spool/epson:
```

The SPARCstation was able to print to it without a hitch. This program can run either as a TSR (what DOS uses because it lacks the capability for UNIX-style daemon processes) *or* in a full interactive mode in which it takes over your PC to use as a print server. Both modes have their place. For example, you could use an old floppy-only XT as a dedicated print server; the full-screen mode displays the status of jobs and lets you control them. If the PC will also be used for other work, use the TSR mode.

The optional package LifeLine allows the PC user two major advances: use of the `tar` program on UNIX to back up the PC's hard disk and the ability to read electronic mail from the UNIX host's mail spool (assuming you have a login and password that you've given to PC-NFS). I have been using `tar` to back up System 1's hard disk for several months, both by giving the `tar` command directly and also through the full-screen interface.

The command line interface to `tar` is almost exactly that of UNIX `tar` (what a happy coincidence; thanks, guys!). For example,

```
C:\> tar cvf unixhost:/dev/rst8
```

will create an archive of the current directory (and all under it), on unixhost's high-density tape drive (/dev/rst8). `cpio` users won't like this, but they can use the full-screen interface to avoid having to learn `tar`'s options.

I was not able to read mail; I suspect this is due to an installation error on my part or some deficiency in my workstation's slightly customized mail system.

Developer's Toolkit

Though you can access the server's files from the PC, you cannot access the PC's files from the server. This would be more interesting in some ways, particularly at sites that use the new high-capacity tape drives, such as Exabyte, to back up all the UNIX systems' disks onto one large-capacity tape. The optional developer's kit could, in theory, be used to make one of the DOS-based NFS servers such as free-software "SOSS" server work with PC-NFS. This would allow the PC's hard disk to be exported to the server, which could then mount it while doing centralized backups. I didn't have time to do anything so fancy with the tool kit, but I did compile one or two toy applications to prove that I could talk to the UNIX systems while PC-NFS was running.

Actually, we had a few problems accessing UNIX printers under DR DOS 5.0 but were just about to upgrade to 6.0, so we did the upgrade and the minor problems vanished. File access worked fine in all environments.

Evaluation

The package does what it claims to. As with any other package that makes UNIX files available under MS-DOS (see *SunExpert*, March, Page 60), PC-NFS has to do "filename mangling," or crunch UNIX's generous filenames into the Procrustean bed of "8.3," the eight-character name and optional three-character extension. While many filenames work out right, some get smashed beyond recognition. Table 1 contains a few examples.

The PC-NFS software includes a helpful UNIX-style `ls` directory lister command that lets you see both the DOS name and the UNIX name; you must use the DOS name given in order to access the file with any DOS utility or application.

When the names don't match, you can use `ls` with `find`, which is DOS' attempt at a `grep` program, as follows:

```
H: \IAN>ls -a | find .profile
~PROF~XM 1069 1-26-90 8:20a U:rwx .profile
```

This example, which was run on DR DOS 6.0, shows using the PC-NFS `ls` command in conjunction with DOS `find` to show that the file .profile has been mapped to the name ~PROF~XM.

Performance

I was not able to try the standard NFS performance benchmarks, as they assume they're running on UNIX. Let's take a look at some timing tests using FTP's built-in timing statistics. This involves just copying files back and forth with ftp. FTP on all systems ends each transfer with a message like

```
1355892 bytes sent in 22
seconds (61 Kbytes/s)
```

Those numbers are for a UNIX system

running from localhost to `/dev/null`. Our attempts to use FTP for timing ran into our only serious problem: the default driver for System 1's 3C501 Ethernet board, and the 3C501 itself. The 3C501 works OK for NFS files and for "rcp," but hangs when downloading files with FTP. Sun blames the board. Later designs, such as the 3C503, work. In fact, they are used in production by the PC-NFS group at Sun.

Sun Tech Support recommended we switch to the NDIS driver for the 3C501. Because of changes in PC-NFS 4.0 to enhance FTP performance, some older, slower 8-bit boards can't keep up. What's an NDIS? NDIS, promulgated by 3Com Corp., Microsoft Corp. and others, is a vendor-independent standard (IS) for network drivers (ND). That's probably not the official acronym, but it's close enough. The third floppy disk of the PC-NFS distribution contains a zillion (count 'em) NDIS drivers for network boards.

Installing the NDIS driver was a bit circuitous because the install, which is separate from the regular PC-NFS installation, assumes you are using drive C:. Otherwise, you have to do a lot of tinkering by hand. But, once installed, this driver, according to the vendor, will allow you to support multiple networks, such as Novell and PC-NFS, on the same PC. The NDIS installation software is due for some fixes in the next release. Installing NDIS for one 3C501 helped, but FTP still was not reliable on the 3C501. It worked fine on the Western Digital board; FTP timings ranged from 85 KB/s to 115 KB/s between a 386DX-20 with a WD8003 board and a Sun-4/330 server, for both binary and text transfers.

Documentation

The documentation is comprehensive and professionally produced. You get an "Installation Guide" (100 pages) that walks you through most of the foibles of PC hardware about which you need to know. It details the supported network boards' configurations. A "User's Guide" (182 pages) tells you how to use the software and includes information on MS-Windows 3.0 and 3.1 and the Norton Desktop. "The Reference Guide" (234 pages), like the "UNIX Reference Manual," contains reference pages for each of the commands listed in Tables 2 and 3, as well as chapters on applications compatibility, including third-party 386 memory managers, system files and a list of all the error and warning messages from PC-NFS. An "Administrator's Guide" (98 pages) tells you how to help your network administrator configure the server for PC-NFS, how to install PC-NFS (including customizing it for environments other than SunOS), how to set up printers and manage the PC-NFS client with SNMP network management, and what to do when things don't work. It ends with appendices on network-based file locking (what works, what doesn't), subnet support and a list of other books to read for information about networking. There is also a slim "Serial Communications Guide" (68 pages) that tells you how to install and use the SLIP, which will normally have to be installed in your SunOS kernel as well as in PC-NFS.

LifeLine users also get a 135-page "LifeLine for Mail and Backup User's Guide," detailing the installation and use of the LifeLine software. A seven-page NFS Commands card and a four-page LifeLine reference card complete the documentation set by extracting all the quick reference material into condensed, pin-it-on-your-wall format.

The system is very well-documented; the only weak section in the documentation is indexing. For example, I was having trouble finding space on one of the PCs to do a full install. The index doesn't tell you where to turn to find out how much space you need. (It's on Page 3 of the "Installation Guide," by the way). The manual says you need "at least 3 Mbytes of disk space" for a full install. But what is a megabyte? Most people think it's a million bytes. But to computer techies, it's 1,024 * 1,024, or 1,048,576. The difference can be important when you're tight for disk space (this is a realistic review done on a PC that several people really use, not

Table 3. Net Commands

Command	Function
net init	Start up network
net name	Specify your userid and password
net logout	Clear your name and password, as when leaving the PC
net use ...	Mount directories or printers
net all	Display network information
net blip	Turn on/off network activity indicator
net cancel	Remove print jobs
net nisdomain	Set NIS domain (like domainname(8))
net nisset	Set NIS server (like ypbind(8))
net pcnfsd	Set PCNFSD server
net print	Send jobs to remote printer
net printers	List printers
net queue	List print jobs for a printer
net route	Set route
set serial	Display license number of this copy of PC-NFS
net start...	Assign or remove hostname
net status	Display status of a printer
net subnet	Set or display TCP/IP subnet mask
net umask	Set or display NFS umask
net version	Display version of PC-NFS

more

PC-NFS

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fax: (508) 671-0262
Circle 116

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Reviewed on:

System 1, XT-class machine (10-MHz 8088, 8-bit 3Com Corp. network board) running Digital Research Inc. DR DOS 6.0 on a network with only a SPARCstation and an Imagen; System 2, a network with several 386s (with 8-bit 3C501 and 16-bit WD 8003 network boards) running MS-DOS 3.3 or 5.0 The system shares a network with about 20 other systems of all makes and models: servers, workstations, X terminals and laser printers.

Best Features:

Full NFS functionality, good documentation and knowledgeable support staff.

Worst Features:

Installation and troubleshooting: some error messages incomplete; some variant installations need considerable handholding (especially the NDIS drivers).

Requirements:

IBM PC or 100% compatible. MS-DOS 3.1 or higher or clone such as DR-DOS 5.0 (6.0 recommended by the author; Sun documentation merely says compatible with MS-DOS 3.1); 640K for DOS mode or 4 MB for MS-Windows mode; two floppies or one floppy and hard drive with 1 MB for basic install or 3 MB for full install; network board; one or more NFS servers, at least one running pcnfsd; most commercial UNIXes provide this program, and source code is included.

Price:

$415

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an idealistic one where each reviewer gets his/her own 330-MB disk to wipe clean after each review). The problem is compounded by the fact that the installation software doesn't tell you how many bytes (or KBs) you are short; it just says that there's not enough disk space.

Overall, the documentation rates a "very good."

Competition

There is no other commercial package available that does exactly what PC-NFS does. This may be why the Open Software Foundation (which Sun people unofficially say is really called Oppose Sun Forever) chose the authentication part of PC-NFS (`pcnfsd`) as the PC part of its network technology platform. To my knowledge, this is the only time OSF has included anything from the competing Sun-AT&T alliance in any of its standards.

The closest competitor product is Beame & Whiteside's TCP+NFS product. This product may be covered in a future review in this series; it has not yet arrived, so I can't give a full comparison.

Another near-competitor is one of various interconnect strategies. Sun's TOPS network for PCs and Macs can be gatewayed into a TCP/IP LAN; this has been in place for years. It works, and many people use it. Also FTP Software's venerable package, PC-FTP, has been supplemented with an NFS package. The industry leader in PC-only LANs–Novell Inc.–which has finally realized that PCs have to be able to talk to the rest of the world and announced a TCP/IP interconnect option. It connects a Novell LAN into a TCP/IP LAN. It is a new product, while PC-NFS has been around for years. A detailed comparison would be informative. However, I don't know enough about Novell to do a fair evaluation of it and have no intention of either learning Novell or writing something on which I couldn't do a good job.

Summary

The PC-NFS package lets you use a PC like you should– as a smart terminal or a simple workstation attached to a UNIX host. You can copy files in both directions with either `rcp` or `ftp`, run commands on the UNIX system with either `telnet` or `rsh`, and use both UNIX files and UNIX printers just as though they were on your local hard disk. You can use it to copy files that you get on 5¼-inch diskettes onto your SPARC-station or other workstation–this is probably cheaper than trying to provision your UNIX workstation with a 5¼-inch floppy. It's cost-effective, it's reliable, and it's fairly straightforward to install. I recommend it for users with modern hardware: for unusual hardware, some UNIX/DOS expertise and/or Sun hotline support may be necessary. ⊸

Ian Darwin may not exist at all. Rumor has it that he is, after all, just an emulation. Email can be sent to his input redirector at `ian@sq.com` or `uunet!sq!ian`.

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SUNEXPERT Magazine
PRODUCT REVIEWS

A Scanner, a Text Processor and a Tape Drive Worth Knowing

by **BARRY SHEIN**, Technical Editor

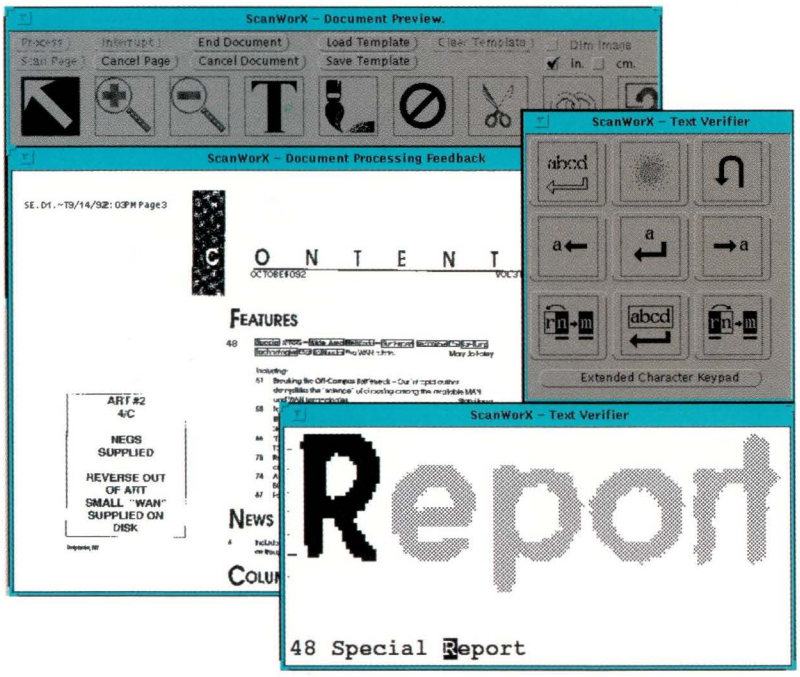
This month's products are a text and image scanner from a familiar name, a text processor with a familiar name, and a 1-GB QIC tape drive with a less familiar name you probably should become acquainted with.

ScanWorX

I like scanners. I particularly like scanners that come with optical character recognition (OCR) software. Add intelligent character recognition (ICR) software, a good point-and-click interface that actually aids productivity and an automatic document feeder and I begin to act like a kid whose dad just bought a toy shop.

ScanWorX from Xerox Imaging Systems Inc. (XIS), coupled with its Model 7000 scanner and automatic document feeder, is just such a system. I do a fair amount of text scanning as a hobby (strange hobby, I know). I put up electronic texts for free public redistribution (The Online Book Initiative). Until now I used a system and software on a Macintosh and likely will again once this review is finished. I always thought that setup was pretty good until I started using ScanWorX; now I know better.

The ScanWorX system can scan images (up to 400 dpi), text and mixed text/image. The original document can be single-sided, double-sided and/or columnized. ICR documents can be saved as plain text (with various line-break options), FrameMaker, Interleaf, WordPerfect, KDOC (used with CALS) and other formats. Images can be saved as TIFF, TIFF CCITT-3, TIFF CCITT-4, Sun Rasterfile or Interleaf Graphics Format. The setup we used was monochrome-only; there is no indication in the software that color is supported on any platform.



ScanWorX can scan images, text and mixed text/images. It sports a good point-and-click interface and well-done intelligent character recognition software.

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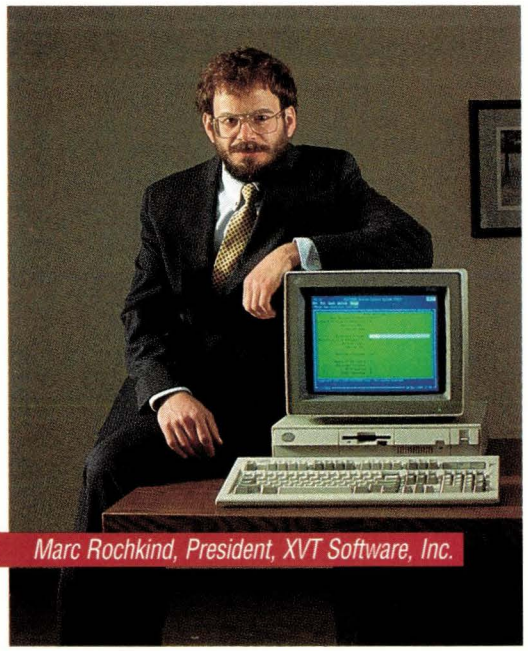
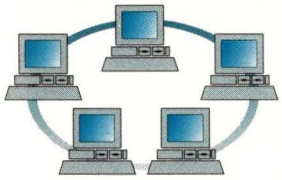


Marc Rochkind, President, XVT Software, Inc.



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– Marc Rochkind

PVCS Version Manager 5.0 provides complete control of versions of your software and it's elements, including binary files. Previous configurations are easily recovered at any time. Parallel development is made safe and productive because conflicting changes are detected and prevented or saved as a parallel development branch. You always know who made a change, when and why it was made, and what was changed. In addition, PVCS Configuration Builder can embed "footprints" containing historic information into compiled code and act conditionally on the information when it uses the code. Footprints in executable code can be read with an included utility. This greatly simplifies bug tracking.

Other new features include:

- Definable promotion models.
- Multilocking and fine-grained lock techniques for better work group access.
- SCCS and RCS archive importing.
- Extensive reporting capabilities.

The PVCS family includes the PVCS Developer's Toolkit that not only makes it easy to connect PVCS functionality to whatever programming environment you use, but also opens the door to much needed application features in commercial applications.

PVCS Configuration Builder is highly compatible with UNIX MAKE. The macro names are the same and the search path logic is identical. Most UNIX MAKE scripts will run without modification.

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When you start ScanWorX, a featureful OpenWindows panel pops up. From this panel you can control the scanner and the various options such as text vs. image vs. mixed, and to what degree you wish to automate the processing. You can also run the scanning software directly from the command line using typical UNIX command-line options to control processing.

There are three major features of the scanning process: Preview, Verify and Feedback. Preview lets you view the bit maps, as they are scanned, in a large document window. Verify opens a smaller window in which to follow the scanning process. With Feedback you can interact with the scanning process; it will pop up questionable or illegible bits of text in the window, and you can tell the software how you wish these to be interpreted.

Xerox claims the character recognition software uses artificial intelligence techniques to learn about a document. As you interact in the verifier, the software remembers the correspondence between bit maps and characters you correct. After a page or two, the software usually has the document format pretty well figured out and you can just scan through the rest of the pages. This verification data can be saved away in a file and recalled later, if, for example, you frequently scan in documents from the same fax or other output device.

In our limited testing, this software seems to do quite well with poor-quality documents, such as faxes or dot-matrix output from low-quality printers. Even if the document is pretty bad, ScanWorX offers several options, such as a contrast enhancement scale, to improve results. The "learning" capability of the software is impressive: On the first page of a low-quality document you might get several errors to verify. As you proceed with each page you can watch the software zip right past text it had problems with previously (such as distinguishing the digit "1" from the character "l".)

For double-sided scanning, you click the appropriate choice in the menu panel, scan in all the odd pages, turn the document over, scan in all the even pages, and ScanWorX automatically collates the pages for you in its memory. The automatic document feeder can handle about 50 pages at a time.

When dealing with multicolumn or mixed image and text, you can either let the software try to figure out for itself which is which (it will actually recognize half-tone images and separate them from text automatically), or you can use the Preview window to interactively select out the various parts of each page.

Another nice feature of ScanWorX is that you can rapidly scan in a sheaf of pages (typically from the automatic document feeder, which works quite quickly) and save them in TIFF format and then go to another console and perform the somewhat slower process of converting the document to text. This frees up the actual scanner for use by someone else, or lets one person feed and scan the document while someone elsewhere (perhaps halfway around the world) performs the conversions.

Several languages, all variations on Latin-1 (Danish, Dutch, English, Finnish, French, German, Italian, Norwegian, Spanish and Swedish) are supported. You can optionally preserve font features such as bold and italic when saving in one of the various text-processing formats. There are various sliders and settings for controlling the confidence levels the software should use in "guessing" which character a bit-map represents.

I like this package a lot. ScanWorX with the XIS 7000 scanner fits somewhere in between industrial-grade scanners and the more lightweight packages typically used with PCs and Macintoshes. I am convinced that the software is absolutely top rate and suited to any application, but, if you are in the business of scanning thousands of pages of text per day, you would be looking for a more heavyweight scanner than the table-top model we used. However, this setup is fine for even moderately heavy work, hundreds of pages per day.

Operation with the Sun and OpenWindows was very good, and the interface design, although not entirely intuitive, is easily understood along with the accompanying manual. The manual itself is very well organized and clear, and repeatedly invites you to call an 800 number at Xerox if you run into any problems. I'll give this package my strong recommendation.

ScanWorX

Model
7000 Scanner and ScanWorX software

Company
Xerox Imaging Systems Inc.

Address
9 Centennial Drive
Peabody, MA 01960

Phone
(508) 977-2000

Tech Support
(800) 248-6550

Price
$14,500 for complete system, including high-speed scanner with automatic document feeder, two SCSI cables and terminator, documentation and two software seats. Additional seats are $1,450 each, but discounts are available for multiple workstations. $1,995, ScanWorX software single node; $1,450, each additional seat.

Best Feature
Intelligent character recognition and artificial intelligence you can use.

Worst Feature
You will need to read the manual to figure out the GUI interface the first time through.

Circle 100

WordPerfect 5.1 for X

The WordPerfect text processor has been around for a long, long time. It runs on many different computing systems including UNIX, DOS, VMS, MVS (IBM/370), AOS/VS, Atari/ST, Amiga and others. The product has a mature feel to it, 1,200 pages of manuals, many options and subsystems and so on. WordPerfect has a lot of fans,

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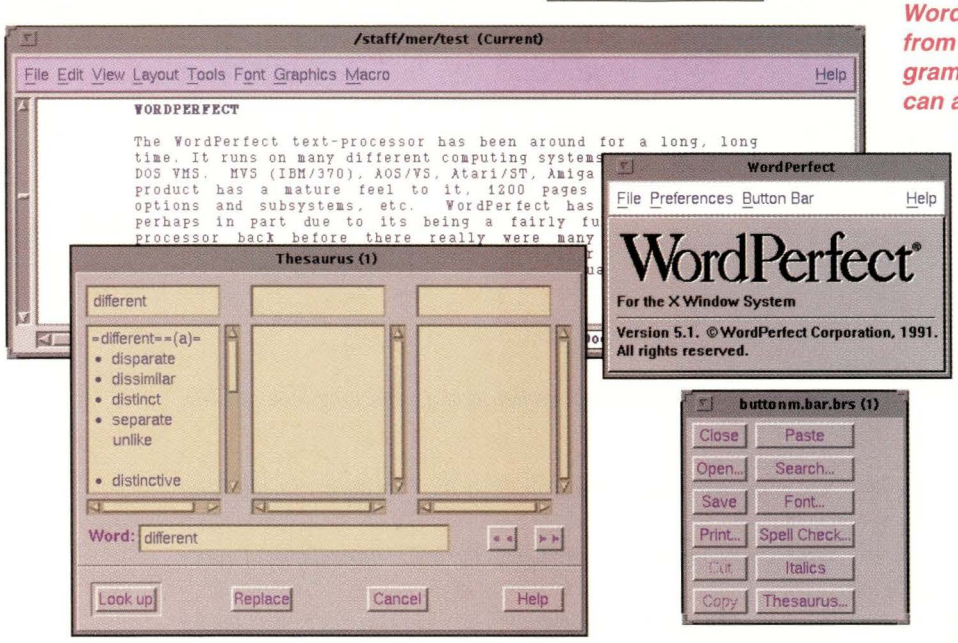


WordPerfect for X benefits from a slick thesaurus program and a button box you can add menu buttons to.

perhaps in part due to its being a fairly full-featured word processor back before there really were many choices on the market. The company has offices all over the world, and WordPerfect itself is available in several languages.

This is my first exposure to WordPerfect (on a Sun IPC) and, honestly, I can't say I was bowled over by the experience. There are two basic interfaces to the system, one character-based and the other using the X11 window system. X11 is WYSIWYG.

The best features of WordPerfect, that I found, were its basic text type-in (font selection, formatting, etc.) and table entry. Tables are very WYSIWYG (is WYSIWYG an adjective?), although the display algorithms sometimes get confused by the presence of a table mixed with text. For example, opening a centered line elsewhere in the page mysteriously causes headers in the table to wiggle up and down. Tables would often get redisplayed wrong, text suddenly slopping over to another column. I discovered that changing the zoom factor back and forth would fix this, but it was disconcerting.

To its credit, WordPerfect can handle plain text files much better than other text processors I've used. This can be handy under UNIX, where you need a text editor to do a lot of common chores such as formatting email messages, unless you have a product that provides another built-in method to do this.

Typing in footnotes and other elements involves being put into another window, which obscures the main document window, and then entering the footnote text. When you are done editing a new footnote, it does appear where it should in the main document, WYSIWYG style. But I found this method of interaction to be annoying and it comes up in a lot of places.

Something else that turned me off was that it was difficult to set up the package. I never figured out some very important features, such as printing. After at least an hour of playing with the company's suggestions and the program it provides to set up a printer "port" (their term, even if the printer is remote or goes through UNIX's `lpr` interface), I just gave up trying to get my rather simple printer setup to work (it was just a remote Apple LaserWriter, a configuration WordPerfect's choices would lead you to believe is supported).

The spelling checker and thesaurus programs are very slick. The spelling checker allows all the operations I would hope, such as telling it to ignore a word for the remainder of this check, or forever, or to use another, alternate dictionary you have created (useful when dealing with jargon). The thesaurus has a nice multipaned panel that puts up your initial search and then lets you scroll and click matches and look those up, the result displayed in the adjacent pane.

WordPerfect's on-line help feature, available for almost every window and popup you encounter, was quite good. Choosing a help button in any context would get you a paragraph or two of assistance specific to what you were trying to do. From the main window, you could get at the entire help system (although it kept complaining about not being able to find files that I know were there).

A few other miscellaneous features make the environment quite pleasant, such as a button box that you can add menu buttons to just by clicking from the main menus. For example, if you want a fast path to the thesaurus, you

WordPerfect 5.1

Model
For the X Window System

Company
WordPerfect Corp.

Address
1555 N. Technology Way
Orem, UT 84057

Phone
(800) 451-5151

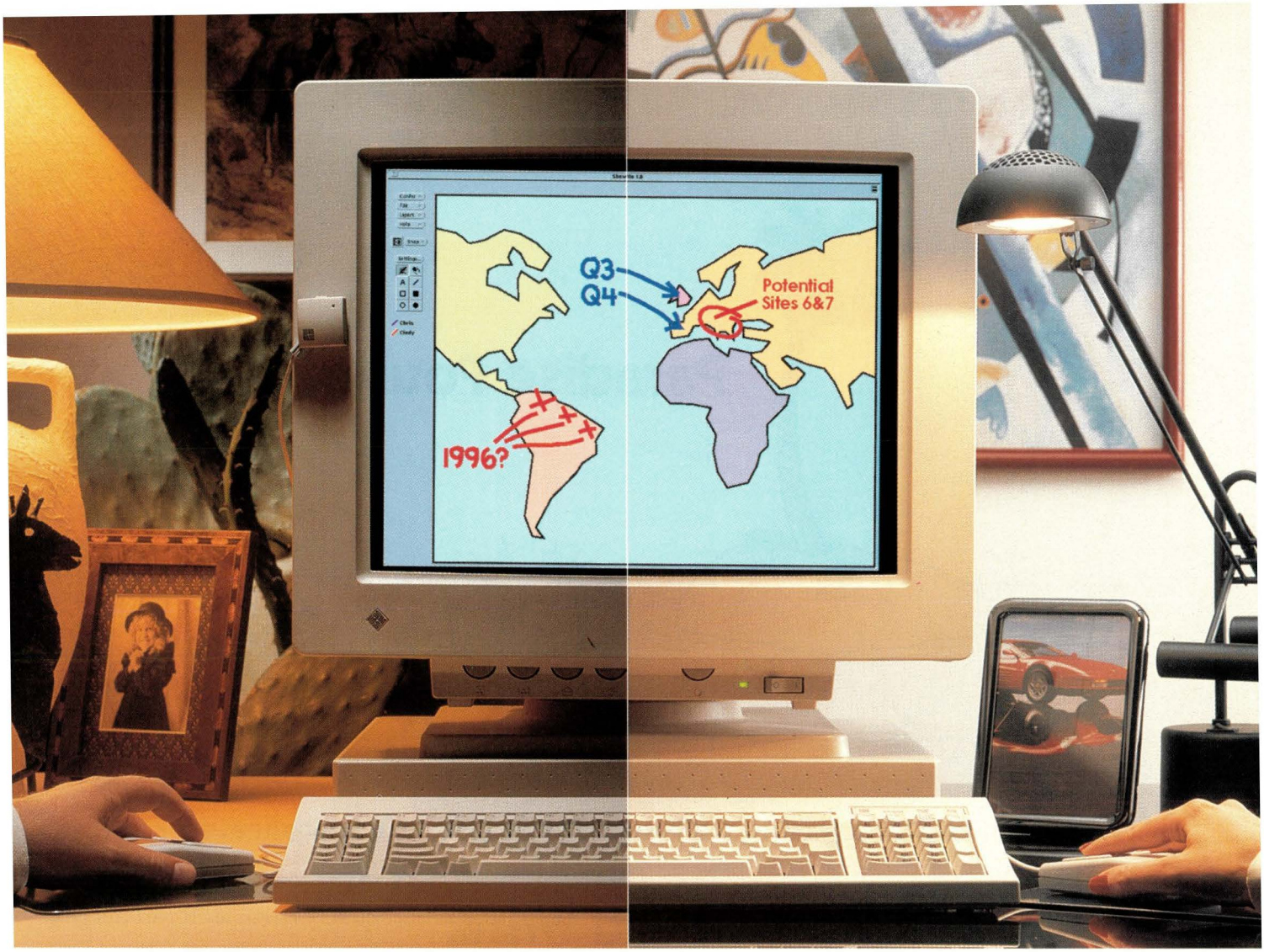
Fax
(801) 222-5077

Price
$495, single-user license; $1,435, five-user pack; $2,772, 10 users

Best Feature
Broad platform support, multiple languages, international offices.

Worst Feature
Printer setup remains a mystery.

Circle 101



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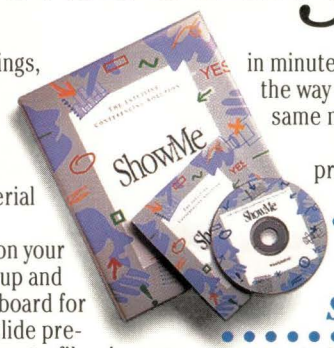

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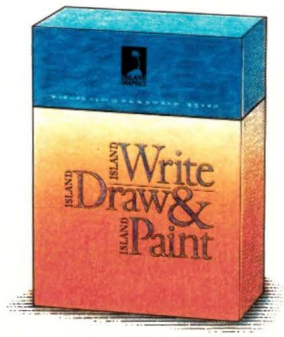

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Circle No. 25 on Inquiry Card

tell it to add to the button box, pick the thesaurus button in the usual way, and it's added to the button box, which stays up next to your window. Another nice feature is the preferences menu in the main WordPerfect menu. Among the many little comfort features is an interactive panel to set the default colors to use for text, menus, backgrounds and so forth.

Overall, the strong points of WordPerfect for Sun are compatibility with other WordPerfect products, particularly for people who already have invested time and effort in learning WordPerfect on other platforms, and the many platforms WordPerfect runs on, allowing you to put a unified word processing face onto an heterogeneous environment. The weaknesses are probably transient and due to WordPerfect's newness to UNIX. The company needs to make the installation and product work more smoothly with UNIX.

Panther-1000

The advent of 8mm technology has left many systems administrators wondering, "Why bother with QIC ¼-inch media at all?" Until fairly recently, 150 MB was about all you could get on a ¼-inch tape, while the 8mm drives were soaring to 2.3 GB, 5 GB and beyond. And the 8mm tape media tends to be cheaper. I've never had a problem at 2.3 GB with 8mm tapes I get for under $6, while ¼-inch tape tends to be around $20 per tape. One remaining reason has been that many vendors still ship their software on ¼-inch tape. Another technology that keeps trying to join this race lies somewhere between these two: DAT. Thus far DAT only stores about half what 8mm stores, has some other potential advantages, and DAT media costs about the same as ¼-inch (i.e., $20 per tape). The low popularity of DAT in the audio market seems to have thus far sealed its fate. They all have their proponents.

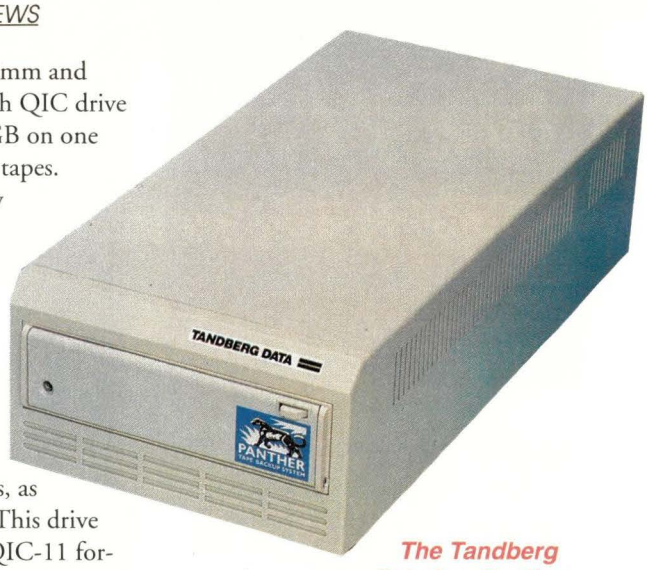
The ¼-inch tape community has certainly gotten this message and has been launching new drives extending the ¼-inch format into realms that were exclusively those of 8mm and DAT. The Tandberg ¼-inch QIC drive we looked at can store 1 GB on one of those familiar cartridge tapes. (Well, you will need a new type of cartridge to store that much, DC9100 or equivalent, but they look familiar.)

The Panther-1000 can read QIC-24 (typically 60-MB) tapes, and read or write QIC-120, QIC-150 and QIC-525 formats, as well as 1-GB QIC-1000. This drive cannot read or write the QIC-11 format that some very old Sun tapes used; however, Tandberg does sell other, lower-density Panther models that can either read or read and write this density.

I tried a simple experiment to test the speed of the Tandberg 1 GB: I attached it to a high-end SPARC clone (Twinhead, dual-SPARC CPU) and wrote four disk dumps, each just over 200 MB for a total of over 800 MB of data, almost the 1-GB capacity of the tape. The entire process took 75 minutes. Compared with our 2.3-GB 8mm, this is not any faster; the 8mm takes about an hour to dump 1 GB (not shocking when you consider that it dumps 2 GB to 120-minute tapes).

So, why would you consider one of these tape drives? One major reason is that you are already committed to ¼-inch tape technology, perhaps your old 60-MB QIC is aging but you don't want to rewrite all those tapes, or you just need another drive and certainly don't want to buy one with five-year-old technology inside. Similarly, you may have a store of software (including Sun software) on ¼-inch tape and may need to read it sometime in the future. With 1 GB of capacity, this tape should also be sufficient to do incremental backups for a few workstations; that may be a convenient plus.

The Tandberg certainly looks solidly built. Installation was trivial: I powered down the SPARC, plugged in the Tandberg, powered it all back on and the system saw it as `/dev/rst0` on reboot without modification. Tandberg builds the QIC drives IBM sells with the RISC System/6000s. I have one of each here, and from the outside they look almost identical (although my RS/6000 drive is a QIC-150 model). If you need a QIC drive, the Panther-1000 looks like a good, solid product.



The Tandberg Data Inc. Panther can store up to 1 GB on a familiar-looking cartridge tape.

Panther-1000

Company
Tandberg Data Inc.

Address
2649 Townsgate Road, Suite 600
Westlake Village, CA 91361

Phone
(800) 258-8285

Fax
(805) 495-4186

Price
$2,995, Sun-compatible

Best Feature
Solidly built, easy to install, 1-GB QIC, supports a broad range of QIC compatibility formats.

Worst Feature
Media price expensive, low-density when compared with 8mm.

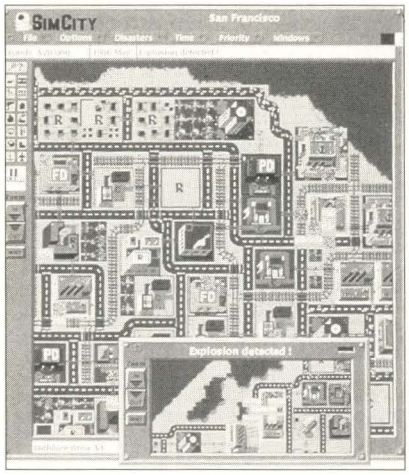
Circle 102

NEW PRODUCTS

The product descriptions are compiled from data supplied by the vendors. To contact them for more detailed information, circle the appropriate reader service number on the card located at the end of the magazine.

SimCity on Suns!

SimCity, the best-selling computer game, is now available on Sun workstations and servers. The game, which

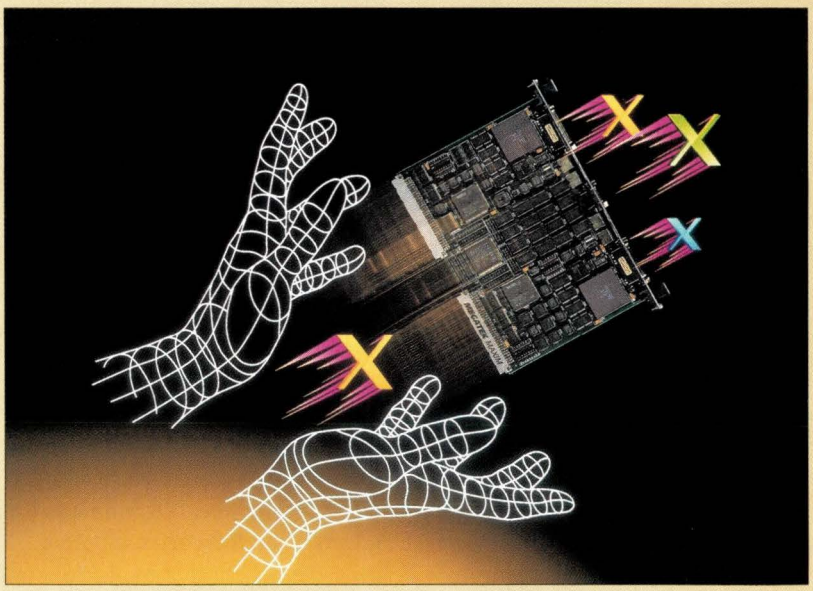


was developed by Maxis Software, has been licensed by Dux Software, in cooperation with Sun, and ported to the SPARC. Like its PC cousin, the Sun version of SimCity will allow the user to create and manage an artificial city. It will differ from the PC version, though, in that the greater power of the SPARC will allow it to have superior graphics and networking. Dux says that it is already working on a version that will be able to import actual map data from leading GIS packages.

Dux says that the Sun version of SimCity is not merely a game but rather a serious training aid for "city and regional planners, students and other GIS professionals." And this may indeed be the case, but it is difficult to believe that the planners, students and others won't enjoy themselves, at least a little bit, when they turn for example to the "Tokyo, Japan 1957" scenario, in which a "large reptilian creature" heads for Tokyo Bay.

Currently, SimCity for Sun is priced at $89 per user. Future versions of the product will include video, networking and additional sound features.

Dux Software
4906 El Camino Real
Los Altos, CA 94022
Circle 104



Megatek VME Graphics

A graphics accelerator for VME systems has been introduced by Megatek. Called the Maxim, the new product allows VME computers and servers, including SPARC-based VME machines and industrial real-time systems that otherwise lack graphics almost entirely, to act as integrated graphics workstations. Graphics tasks, including font management and the manipulation of bit maps and pix maps, are offloaded from the host CPU to the Megatek board, which provides a performance of 1,400,000 vectors per second. The product can accelerate the performance of the X Window System, or add X where it might otherwise be absent.

Maxim is a 6U VME board that comes with optimized and supported X11R5 software. At first, the product will be available for SPARC VME and Motorola Inc. 88000-based systems. It supports OpenWindows, SunView and Motif on SPARC systems. Prices start at $3,995.

Megatek Corp.
9645 Scranton Road
San Diego, CA 92121
Circle 103

Data Analysis and Reduction

Probe, BBN's data analysis and reduction package, has been ported to Sun workstations and compatibles. Previously available only on DEC VAXes, Probe allows engineers to take very large amounts of data and quickly locate important trends or events within it–thus "reducing" the data to only the components that are significant. With Probe, users can take data, chart it via x-y plots and histograms, visualize it with animated graphics, analyze it with a number of built-in manipulation functions (including FFTs) and work with it interactively.

The company says that Probe can

THE SUN ENQUIRER

Volume XXII No.19 Special Edition One Dollar

8MM TAPE DRIVE TELLS ALL!

Built-In Display Reveals The Most Intricate Details Of Backup.

After delivering the keynote address at a recent trade show, the TTi 8501 granted The Sun Enquirer an exclusive backstage interview.

Sun Enquirer: We hear your built-in display is the greatest thing since transistors replaced tubes!

8501: Well, I wouldn't go that far. But DP managers sure love it. It tells you if there's enough unused tape in a cartridge to complete your backup. It lets you know if the tape is in good condition. And it even reminds you when it's time to install a cleaning cartridge.

Sun Enquirer: That's terrific! But fill us in on some basics. What's your speed and capacity?

8501: I can hold five gigs on a standard 8mm cartridge and my sustained data transfer is up to 500 kilobytes per second.

Sun Enquirer: How about your average seek time?

8501: In high-speed search mode I can find any file on a tape that contains 5,000 megabytes in about 60 seconds.

Sun Enquirer: That's fast! But I think our readers would really like to know if you're still doing work with some of the top CPUs in the business?

8501: You better believe it! I'm compatible with all kinds of SCSI-based systems. Not to drop names, but some of my best friends are VAXes, Sun SPARCstations and servers, IBM PCs and RS/6000s, HP/Apollos, and Macs.

Sun Enquirer: Boy, you really do get around! Is it hard to get along with so many different hosts?

8501: Not really. You see, the engineers at TTi designed me with 12 little switches on my back panel. By changing the settings I can speak almost any language.

Sun Enquirer: That must really come in handy in a multi-host environment. Do those switches do anything else?

8501: Of course! Besides setting the emulation, they change my SCSI address and let the user choose options like fast file search, short file mark enable and more!

Sun Enquirer: I suppose those switches also help you get along with 2.3 gigabyte 8mm drives?

8501: You got it. I can read tapes that were written by 2.3 gigabyte drives and write tapes in EXB-8200 mode, so they can be read by any 2.3 gigabyte drive.

Sun Enquirer: Mr. 8501, thank you for talking with us today. If folks want to learn more about you, what should they do?

8501: Either call (714) 693-1133 or drop me a line at TTi. I take all my calls and I always answer my mail. Well, gotta' go, but I hope I'll be talkin' to you soon!

Backup so easy, you can do it with your eyes closed.

TTi TRANSITIONAL TECHNOLOGY, INC.

5401 E. La Palma Ave., Anaheim, CA 92807
Phone: **(714) 693-1133** FAX: (714) 693-0225
In the U.K. call (44) (295) 269000.

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Circle No. 48 on Inquiry Card

take data from databases or can be customized to take input directly from instrumentation in real (or near-real) time. Pricing begins at $13,000.

BBN Systems & Technologies
10 Moulton St.
Cambridge, MA 02138
Circle 105

PHIGS Browser

A development tool for PHIGS programs has been introduced by Pixel Perfect Software. Called the PHIGS Browser, the product is a window-based software tool for debugging and optimizing PHIGS programs. The company says it allows the user to view the PHIGS Central Data Store.

Users can view and traverse the PHIGS display list and inquire the contents of structure elements. They can also move to any point in the display list and inquire current state list values. Pricing begins at $895 per seat.

Pixel Perfect Software Inc.
185 Blunk St.
Plymouth, MI 48170
Circle 106

SBus Multiport Board

Aurora Technologies has introduced a multiport board for the SBus. Called the Multiport Model 420S, the product provides four serial and two parallel ports on a single SBus card. The two parallel ports are Centronics-compatible and provide links to printers, plotters and so forth. The four RS-232 ports are meant to connect to terminals, modems and digitizer. The 420S comes with a SunOS device driver.

Pricing on the 420S begins at $795. It comes with a user's guide, a molded plastic breakout cable and a one-year limited warranty. The warranty provides overnight replacement for the first year and telephone support for the life of the product.

Aurora Technologies Inc.
176 Second Ave.
Waltham, MA 02154
Circle 107

Occam Would Be Pleased

Tower Concepts has announced software that allows software developers to track problems and manage the evolution of their own code. Called Razor, the product is a tool suite that allows users to manage problem reports, check files in and out for edits, prioritize efforts and generally coordinate actions. Moreover, the product contains facilities for version control, the management of branching development lines and gathering files for eventual product release.

The company says that Razor is meant for developers who either do not want, or cannot afford, the large, expensive and complex configuration management tools that have traditionally been used in major development efforts. Razor runs on SPARC-based systems. Pricing begins at $229, with discounts for volume purchases.

Tower Concepts
103 Sylvan Way
New Hartford, NY 13413
Circle 108

Instrument Catalog

National Instruments, the well-known vendor of laboratory test and measurement software and hardware, has

Upgrades, Enhancements, Additions...

• Spry has introduced its MS Windows Interfaces for Sun's PC-NFS. The company says that Spry AIR allows PC-NFS to exist on a PC within the Windows environment. Pricing begins at $100. **Spry Inc.**, 1319 Dexter Ave. North, Suite 150, Seattle, WA 98101. **Circle 109**

• A upgraded version of statit, Statware Inc.'s statistical and graphical data-analysis system, has been introduced. Version 3.0 offers improvements in such areas as user interface and modeling functions. **Statware Inc.**, 260 SW Madison Ave., Corvallis OR 97333. **Circle 110**

• Networking vendor 3Com has upgraded the software on its NETBuilder bridging and routing platform. The NETBuilder 5.1 software broadens the NETBuilder platform's abilities with routing for token-ring networks, increased protocol support, extended WAN services and several new Ethernet-to-token-ring features. Pricing ranges from $250 to $1,500. **3Com Corp.**, 5400 Bayfront Plaza, P.O. Box 58145, Santa Clara, CA 95052-8145. **Circle 111**

• It is now possible to encrypt data on Contemporary Cybernetics Group's optical and 8mm backup systems. The company's CY-8200 and CY-8500 8mm tape subsystems and CY-2000-S optical disk drives now feature a data encryption option whereby only users with special security cards can access sensitive data. **Contemporary Cybernetics Group**, Rock Landing Corporate Center, 11846 Rock Landing, Newport News, VA 23606. **Circle 112**

• NetLabs has upgraded its network management software, Netlabs/ Manager and NetLabs/Discovery. The new versions of the products feature tools that make it easier for users to manage the configuration of their networks, map out their looks and monitor problems while they occur. **NetLabs Inc.**, 4920 El Camino Real, Los Altos, CA 94022. **Circle 113**

• An Ada code generator has been added to ezX, the user interface management system from Sunrise Software International. ezX runs atop OSF/Motif and supports screen layout, color editors, font editors, image editors, presentation tools and dynamic dialogue management. **Sunrise Software International**, 170 Enterprise Center, Middletown, RI 02840. **Circle 114**

• QMS has dropped the price of its QMS-PS 1700 printer. The 1700 is a 600-dpi laser printer that attaches to Ethernet or token ring. It will drop in price to $6,995, down $1,000. **QMS Inc.**, One Magnum Pass, P.O. Box 81250, Mobile, AL 36689-1250. **Circle 115**

• A software upgrade for the Annex terminal server line has been announced by Xylogics. Annex Version 6.2 features improvements that make it easier for users at remote locations to dial into the network. The product also has a new Telnet-to-LAT gateway. **Xylogics Inc.**, 53 Third Ave., Burlington, MA 01803. **Circle 116**

released its 1993 catalog. The publication includes the company's products for Sun, IBM, DEC and HP/Apollo workstations. In particular, the company is releasing this year its LabVIEW software, which allows scientists and engineers to quickly cobble together lab software using graphical elements rather than traditional programming tools.

In addition, the product highlights new GPIB and VXIbus interfaces, as well as tools for use in such applications as laboratory automation, data acquisition, process monitoring and control, physiological monitoring, personal instrumentation, automated testing and so on. The catalog is free.

National Instruments
6504 Bridge Point Parkway
Austin, TX 78730-5039
Circle 117

Why Doesn't OSHA Have It?

The Canadian Centre for Occupational Health and Safety (CCOHS), the government agency that serves to promote health and safety in the Canadian workplace, has published a CD-ROM version of its CCINFOdisc database. Stored on six CD-ROM disks, the database contains such things as a registry of the toxic effects of over 109,000 substances, thousands of safety regulations, information on chemical and environmental hazards and so on.

Prices for the disks range from $250 to $350, which includes quarterly updates, a license to use search and retrieval software, user documentation and telephone support. The suite is available for Sun workstations, as well as DOS machines and the Macintosh. But, regardless of platform, employers and employees south of the border, in the United States, may well wish that Washington would produce a similar library.

Canadian Centre for Occupational Health and Safety
250 Main St. East
Hamilton, Ontario
L8N 1H6, Canada
Circle 118

Intelligent Network UPS

An intelligent uninterruptible power supply (UPS) that is also an SNMP node has been introduced by Liebert. The UPSstation can be configured as either a basic UPS, or it can be a network UPS that can be managed as an intelligent peripheral under the SNMP from any point within that network. A network manager could, for instance, monitor the health of the network and of the UPS and manage both, from a remote console.

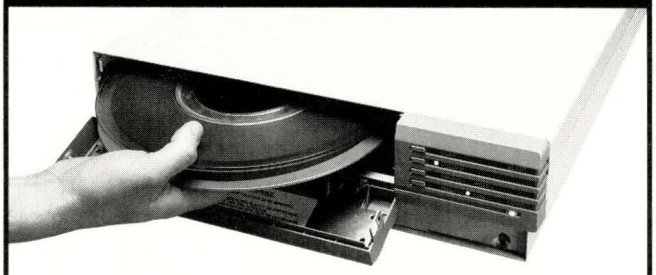
There are several models of the UPSstation, ranging from 3KVA to 6KVA. A programmable battery test allows the user to check battery backups at specified times. The product also offers 200,000 hours MTBF. Pricing ranges from $3,000 to $5,000.

Liebert Corp.
1050 Dearborn Drive
P. O. Box 29186
Columbus, Ohio 43229
Circle 119

600 dpi for under $4,500

From CalComp comes the CCL 600, a tabloid/B-size monochrome laser printer with a resolution of 600-by-600 dpi. Letter/A-size paper can also be accommodated, and resolution may

9-track tape on your workstation:



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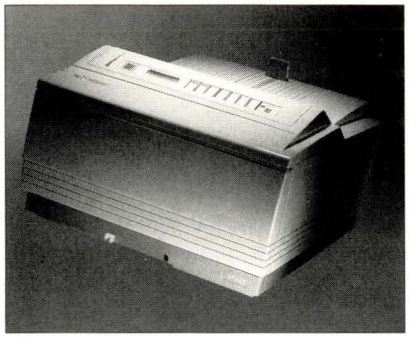

be switched to 300-by-300 dpi. The CCL 600 is ideal for CAD/CAE printing as well as for general office applications. Multiple copies of letter-size images are printed at 8 ppm and tabloid-size pages at almost 5 ppm.

The printer is PostScript compatible via Microsoft Corp. TrueImage and is also HP-GL/2 and PCL5 compatible. The printer's high throughput is the result of a built-in graphics accelerator and parallel processing architecture. The printer comes standard with RS-232-C serial, Centronics parallel and AppleTalk interfaces plus two PCMCIA slots for future add-on fonts and emulations. For networking capability, automatic I/F and emulation switching are also standard. A SCSI interface is available as an option.

Pricing is $4,495, including a one-year warranty.

CalComp
2411 W. LaPalma Ave.
Anaheim, CA 92801
Circle 120

NeWSprint Electron Printer

A NeWSprint printer that employs a 300-dpi dielectric imaging process has been introduced by Olympus. The IS2016D attaches to a Sun workstation or compatible via an SBus printer card. Its printing engine uses a matrix of 2,456 electrodes. When an electrode is selected, it emits a stream of electrons to a print drum, which then passes over a developing unit that contains toner. The toner is then electrostatically transferred to paper. This method of printing is said to be less demanding and more reliable than that of laser printers.

The IS2016D prints 12 ppm in duplex mode; 20 ppm, simplex. It comes with NeWSprint 2.0 from SunPics. It includes 57 scalable F3 fonts and Printers Pallet with 600 F3 fonts. The printer has two 250-page paper cassettes. There is also an optional large capacity feeder that holds 1,000 sheets. Pricing begins at $5,995.

Olympus Image Systems Inc.
15271 Barranca Parkway
Irvine, CA 92718-2201
Circle 121

Materials Data Bank Available

Four new materials databases have been introduced by PDA Engineering. These databases, called the Producer Databanks, provide producer-supplied materials data on plastics, metals, ceramics and composites for use in initial design evaluations. The data banks

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4/330 System	4/20 SLC	Color Buffer
4/280 System	3/80 System	Mono Buffer
4/260 System	3/60 System	3/50 System
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RAVE COMPUTER ASSOCIATION INC.

Rave Computer Association, Inc.
36960 Metro Court
Sterling Heights, MI 48312

Sun is a trademark of Sun Microsystems, Inc.

Circle No. 52 on Inquiry Card

can be searched and manipulated with the company's M/VISION or PATRAN system analysis software.

The Producer Databanks contain mechanical, thermal, electrical, optical and chemical properties for 16,853 distinct materials, including 17,635 tables and 1,460 graphics. The product runs on Sun and other UNIX workstations. Pricing begins at $2,000.

PDA Engineering
2975 Redhill Ave.
Costa Mesa, CA 92626
Circle 122

Graphics Software Suite

Strasbourg-based Caldera Systems has introduced a suite of graphics software modules for image processing and multimedia computing. The individual modules of the package are Calichrome, Caledre, Caliray, Cameleo and Melies. Each of these can link to the other. Calichrome is color palette software, which combines publishing features with such tools as pen, brush, patterns, stencils and so on. Caledre, meanwhile, is vectorized drawing software.

Melies is animation software for 2D vectorized objects and images. Cameleo is image acquisition and processing software, while Caliray is rendering software that exploits ray tracing. U.S. pricing has not yet been established. The company says it is actively seeking American and Japanese distributors.

Caldera Systems
10 Rue Des Pontonniers
BP 403 R1
67001 Strasbourg Cedex
France
Circle 123

Every Phone Number You Could Want

Most of the phone numbers for every city in the United States are now available on CD-ROM, if you want them. ProCD Inc. has announced that its ProPhone product, a set of three CD-ROMs, contains almost all of the nation's phone listings, including both residential and business numbers. There are three disks: a Business disk, an Eastern Residential disk and a Western Residential disk.

The business disk alone contains over seven million listings, and those seven million can be searched by name, business heading or SIC (standard industrial classification codes). The residential disks can be searched by name, address, Zip Code and so on. The company says that the residential disks will be useful for individuals who wish to look up old friends, but one might suspect that telemarketers might find them useful as well. So, the next time the phone rings at precisely the moment you sit down to supper and you pick it up to find a call from a computer named Bob who wants to sell you a time-shared condo in Guam, you might want to spend a moment thinking about the wonders of the information revolution. Pricing is $349.

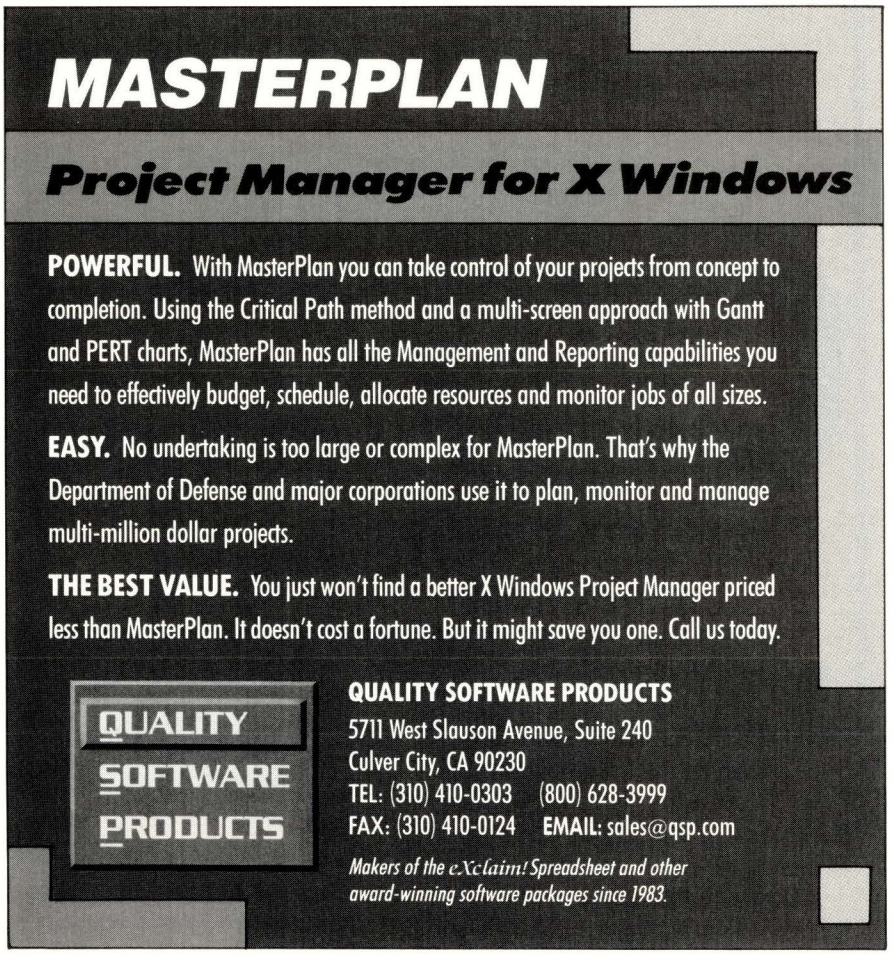
ProCD Inc.
8 Doaks Lane
Little Harbor
Marblehead, MA 01945
Circle 124

Alpha for SPARC

Software that allows Sun SPARCstations, SPARC-based servers and SPARCalikes to drive Alpha terminals has been released by JSP Computer Systems Ltd. Alpha terminals are like ASCII character terminals except that they support windowed displays. In theory, most of the character-based applications (which form the bulk of UNIX commercial applications) can run on such terminals with only minor modifications. The AlphaWindows standard was developed and is promoted by the Display Industry Association.

JSB's AlphaWindow software is MultiView Mascot. It allows a SPARC-based system to act like an AlphaWindow host system. The company says that Mascot fully complies with the AlphaWindow standard and thus allows a user to run up to six applications at a time, either in windows or in full screens, with hot keys to switch between applications. Pricing was unavailable as of press time.

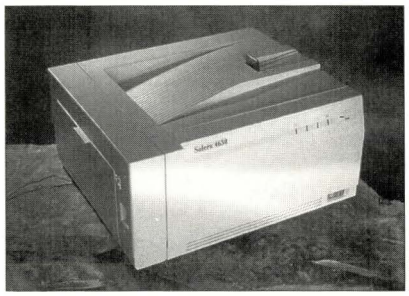
JSB Computer Systems Ltd.
Cheshire House
Castle St.
Macclesfied, Cheshire
England, SK116AF
Circle 125



Circle No. 36 on Inquiry Card

Personal NeWSprint Printer

Specialized Printing Solutions has introduced a NeWSprint printer for Sun workstations and compatibles.



The Solera 4630 is a 600-by-300-dpi, 4-ppm printer that attaches directly to a SPARCstation or SPARCalike via the SCSI port, which the company says is an advantage since it saves scarce SBus slots for other peripherals.

As a NeWSprint device, the Solera relies on the workstation rather than a native CPU to perform printer processing. The product of a joint effort between Specialized Printing and Mitsui Comek of Mitsui & Co. Ltd., the Solera uses the industry standard Canon EP-L cartridge. Pricing begins at $1,995.

Specialized Printing Solutions
2464 El Camino Real, Suite 590
Santa Clara, CA 95051
Circle 126

William Tell Would Have Been Proud

A new and radical alternative to the mouse has been introduced by Origin Instruments. The DynaSight Sensor is a small, low-power optical radar that sits on top of a monitor. The sensor then measures the position of a dot-like target that users wear on their foreheads. In this fashion, the company says, the sensor allows the workstation to change the display according to the position of the viewer.

The company is targeting the product at applications with complex, 3D displays where the user is viewing a great deal of information interactively. However, the Sensor can also be used as a more mundane mouse replacement. The Sensor links to its host via the RS-232. The measurement update rate is 33 Hz. The company says that the product will not interfere with other specialized viewing hardware, such as stereoscopic glasses. Pricing for a developer's kit begins at $2,995.

Origin Instruments Corp.
854 Greenview Drive
Grand Prairie, TX 75050
Circle 127

PC-to-UNIX and X Windows Link

Software that allows UNIX systems and X terminals to link to DOS machines has been introduced by Tera Technologies Inc. Called Network PC Access (NPA), the package runs on a UNIX workstation or host and allows users to remotely access DOS applications, network file servers and PC peripherals over a network.

Tera (no relationship to the recently defunct semiconductor vendor of similar name) says that NPA redirects a workstation or terminal's keystrokes or mouse movements to a remote PC. The PC's display is then diverted to a window on the UNIX system or X terminal. NPA is compatible with PC-NFS and uses TCP/IP for communi-

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cation between the NPA Client workstation and NPA Server PC. Pricing is $495 for the server version of the software and $95 for the client.

Tera Technologies Inc.
7755 S.W. Cirrus Drive
Beaverton, OR 97005
Circle 128

Does Ms. Sommers Know About This?

An exercise device for office workers is being promoted as a defense against repetitive motion injury and carpal tunnel syndrome. With Omni-Flexor, a set of handles attached to a central pivot, users rotate one set of the handles to "safely develop all six motion ranges of the wrist." The company says the device is FDA-registered and in use at the Mayo Clinic's Physical Medicine and Rehabilitation Center. Pricing was unavailable at press time.

Omnitech Research
15475 N. Greenway-Hayden Loop
Suite B10
Scottsdale, AZ 85251
Circle 129

NCD Shows Small X Terminal

A new 15-inch X terminal based on the MIPS R3000 processor has been introduced by NCD. The NCD15r offers a 15-inch display at 1,024 by 800 pixels. The product comes with 4 MB of DRAM, expandable to 20 MB using single in-line memory modules (SIMMs). The company says that R3000 products provide performance of over 90,000 Xstones.

The X terminal's screen provides 100-dpi resolution and a 70-Hz non-interlaced refresh rate. The product's base is 13 inches square and contains a fanless internal convection-cooling system. Pricing begins at $1,695.

Network Computing Devices Inc.
350 North Bernardo Ave.
Mountain View, CA 94043
Circle 130

DATs Real Improvement

The new ArchiveST 4000 DAT drive from Maynard offers storage capacity up to 8 GB on a single 4mm tape cartridge and up to twice the data-transfer speed of earlier drives. A MTBF of greater than 40,000 hours at a 30% duty cycle is claimed by the company.

This drive supports the IBM Corp., Sun, NeXT Inc. and other PC-based UNIX workstations. External and internal configurations are available.

Pricing is $2,700, internal, and $3,150, external.

Maynard Electronics
An Archive Company
35 Skyline Drive
Lake Mary, FL 32746
Circle 131

Corrections

In our September Feature entitled "(Somewhat) Rested and (Sort of) Ready," the photo on Page 82 depicts the Aries Research Inc. SPARCstation 2 clone, the Parrot II.

The News photo caption on Page 8 of the October issue should have read $1,600 for the Super Workstation Inc. SS2 CPU board.

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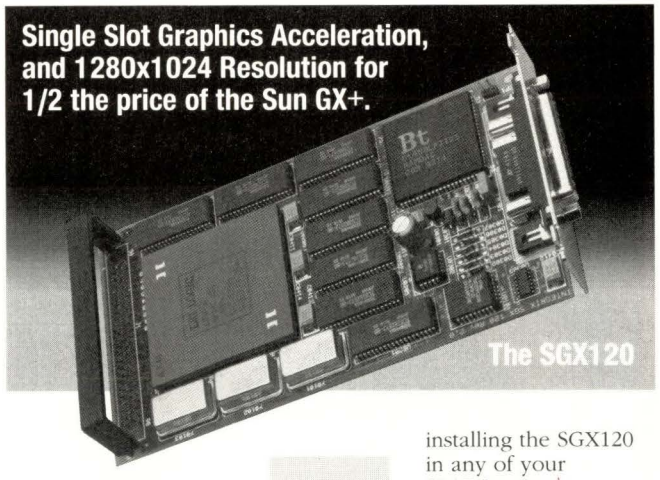

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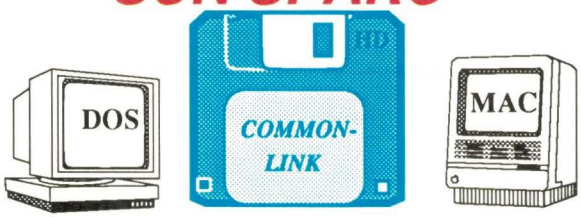

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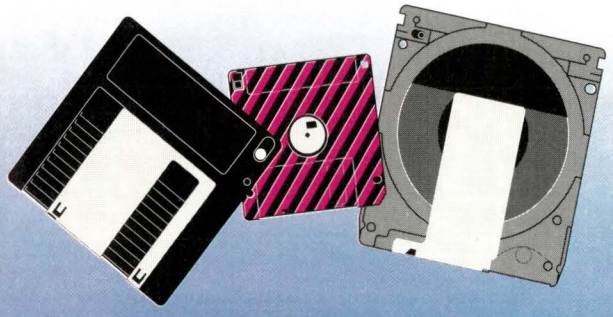

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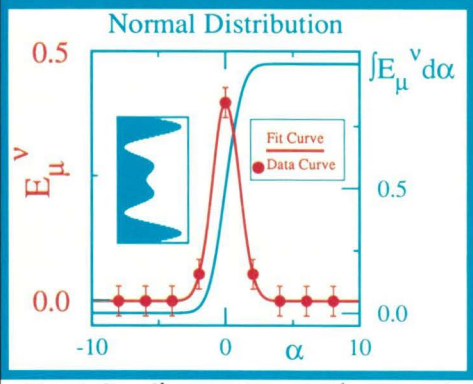

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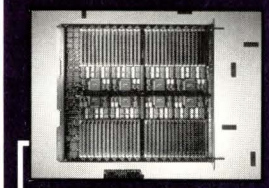

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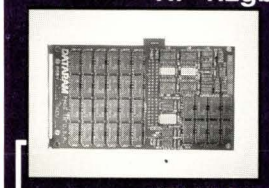

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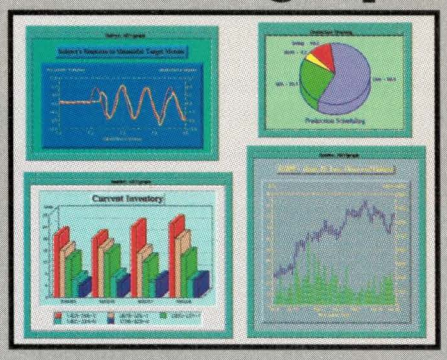

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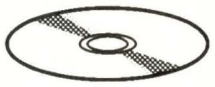

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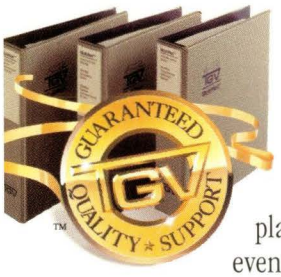

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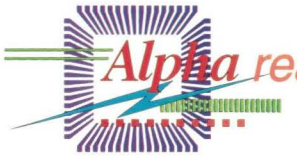

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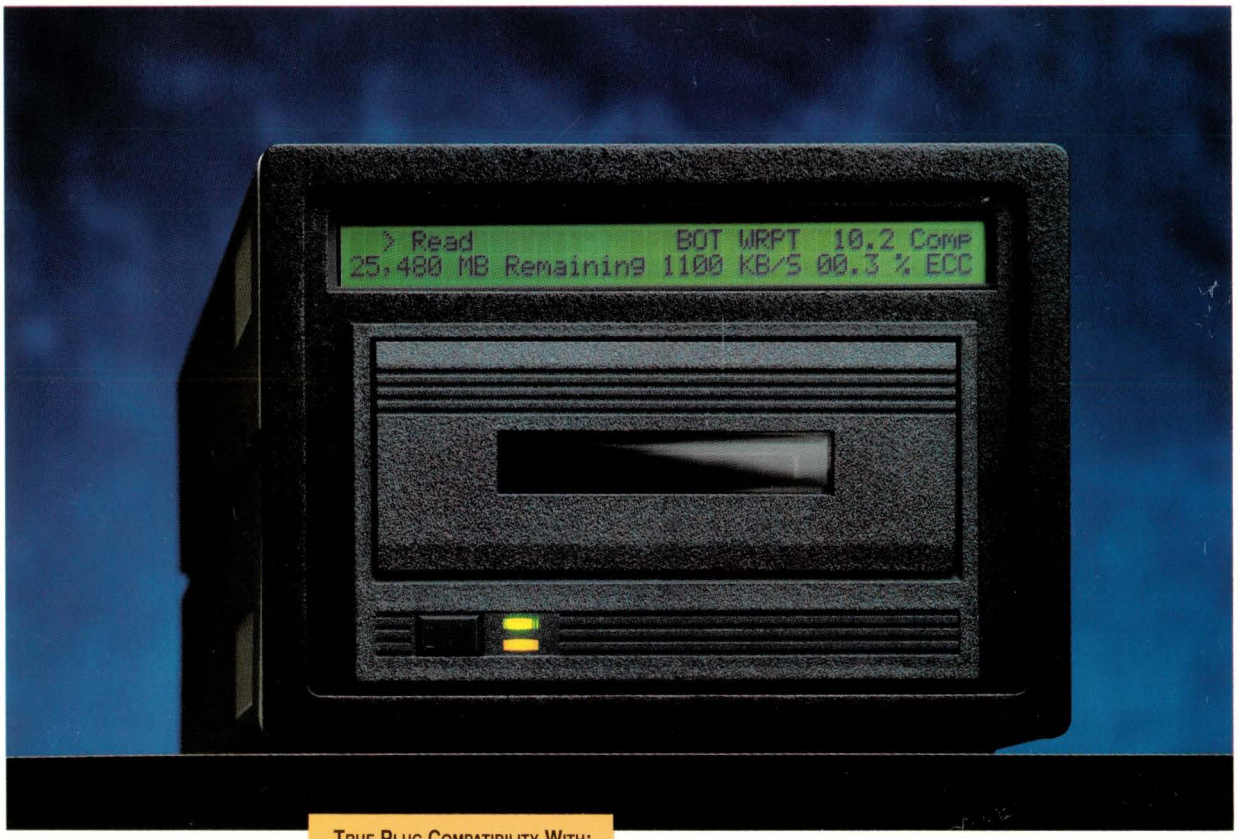

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